Government of India

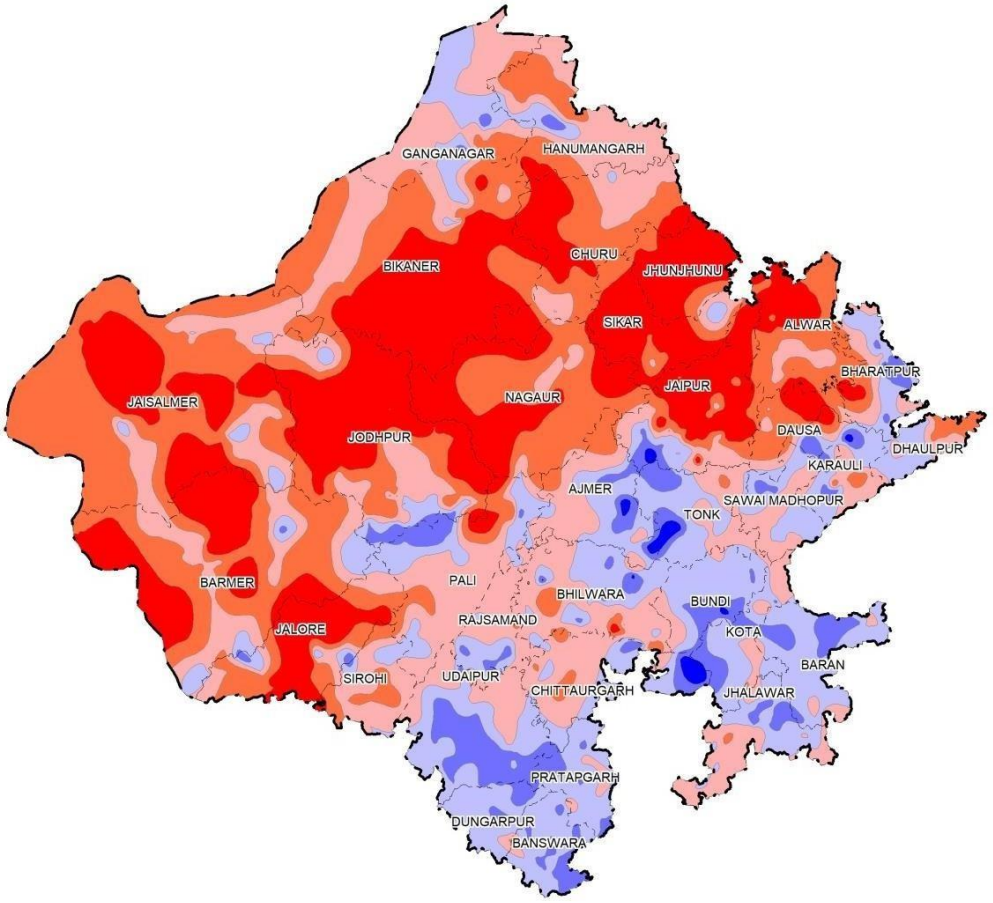
Central Ground Water

Board

Department of Water Resources, River Development & Ganga Rejuvenation

Ministry of Jal Shakti

State Ground Water Quality Report 2023-2024, Rajasthan



Western Region,

Jaipur 2023-2024

Preface

Groundwater is an important natural resource and is considered as a precious national asset. It is a major constituent of all living beings.Unplanned and accelerated development of this prime natural resource is creating concern among scientists, users, policy makers and other stake holders.

Government of India initiative to provide safe and adequate drinking water supply to every households in Rural India by 2024 and implement source sustainability measures such as recharge and reuse through grey water management, water conservation, rain water harvesting, etc. As per directions of the Ministry of Jal Shakti, Govt. of India this **State Ground Water Quality Report for the year 2023** has been prepared. The two main concerns in the State are depleting ground water resources due to decline in ground water levels and another major concern poor quality of ground water. Water quality is one of the main challenges that the societies will face during this century. This report contains compilation and statistical analysis of Water Quality Monitoring data generated through montoring of Nation Hydrograph Stations (NHS) of CGWB during April to May 2023, spread over the Rajasthan State. The water quality samples are analysed at NABL accredited Regional Chemical Laboratory, Jaipur. The report attempts to briefly describe an over view and general conclusion based on the basis of water quality data of water samples. This report will provide detailed information on chemical quality extent of contaminants occurring in groundwater of the State.

State Ground Water quality report /Year book 2023-24 has been compiled & edited by Dr. Jaipal Garg Scientist “C” (Chemical), Ms. Aruna Saini, Assistant Chemist, Ms. Shivani Shukla, STA (Chemical) based on the data analysis. The report was completed under the supervision of Dr. Rakesh Kushwaha Scientist "D" and valuable suggestions from Sh.R.K. Verma Scientist "D". The analysis of water samples were carried out by Dr. Jaipal Garg Scientist “C” (Chemical), Dr. Prerna Mathuriya, Sc.B (Chemical), Ms. Aruna Saini, Assistant Chemist, and Ms. Shivani Shukla, STA (Chemical). The Maps were prepared by Sh. Lokendra Kumar, Draftsman.

I am sure that this report would of great use in planning, formulation and implementation of various ground water-based schemes in the Rajasthan State for better management of the available ground water resoruces and to ensure quality for sustainable development of the State. This data will also be useful for the Scientists, Academicians, NGOs, and Individuals etc in their research studiesand in resolving the water quality issues of the State.

18/10/24

(Er. M S Rathore)
Regional Director

Contents

EXECUTIVE SUMMARY

1. Water is the basis for all life forms and is a vital component for our life support system. Ground water plays an important role in domestic water supply, agriculture and for industrial use. Rajasthan State is under severe stress regarding ground water quantity and quality and its management. The State is situated in the northwestern side of India. It is the largest State in the country comprising of 33 districts with geographical area of 3,42,239 square kilometre (sq km). It is situated between north latitudes $23^0$03' and $30^0$12' and east longitudes $69^0$30' and $78^0$17'.

2. Rainfall is the principal source of ground water recharge in the state. In canal irrigated areas, a part of canal water through seepage from conveyance system and part of water i.e. utilised for irrigation also returns to ground water and contributes to storage. The state receives 90 % rainfall from southwest monsoon from June to September. The average annual rainfall of the state during the period 2023 works out to be 695.0 mm.

3. The ground water occurrence movement and availability in Rajasthan is controlled by hydro geological situation. Diverse rock types ranging from the oldest Archaean rocks to sub- Recent alluvium and wind- blown sand are exposed in Rajasthan. In a major portion of the area, particularly in western Rajasthan, the oldest rocks are concealed below a thick cover of alluvium and wind- blown sands.

4. It is imperative to have knowledge of ground water quality for the entire State as well as each district, for its better use and effective management. 298 water samples were collected from uranium affected districts in Rajasthan with the objective to assess the contamination in and around the hot spots & this report has describe the water quality the 33 districts of Rajasthan State for finding its suitability for drinking purposes .

5. The ground water quality data generated during the study have been compared with the standards/guideline/regulation laid down by Bureau of Indian standards (BIS with objective to identify the extent of degradation and to establish the basis for improvement.

6. The ground water quality analysis results in Rajasthan has indicated higher values of Electrical conductivity, Chloride, Nitrate and Fluoride vis-a-vis drinking water standards and the violation of Water quality standards have been observed at many places in surveyed districts of the State.

7.**TDS:** Out of 630 sample analysed, it si observed that the TDS content is beyond the permissible limit of 2000 mg/l in ground water occurring in Barmer (81.48%),Nagaur (74.36%), Jodhpur (69.44%), Jaislmer(63.64%), Churu (61.36%), Bhartatpur (61.11%), Dausa (60.00%), Jalore (56.62 %),Karauli (54.55%),Jaipur (53.13%),Jhunjhunu (52.63%), Hnaumangarh and Tonk (50% each), Pali947.37%), Bhilwara (44.44%),Ajmer (42.86%) & Bikaner(40.54%). Data

reveals that most of Western parts and North West parts of the State are having very poor water quality for drinking water. In 2023 trend analysis was carried out and it was found that 48.73 % samples were having TDS values beyond the permissible limit and periodic variation shows that the water quality has continuously detoriated from 2020 to 2023. More change is show in data from 2022 to 2023 due to revise WQ policy-2023

8. **Chloride:** Out of 630 sample analysed, 26.51 % samples have Chloride content beyond the permissible limit of 1000 mg/l, 40.16 % between acceptable and permissible limit and 33.33 % samples are within the acceptable limits. In Nagaur (53.85 %) district, Barmer (51.85%) , Jodhpur (47.22 %), Jaisalmer (39.40%), Jalore (39.13%), & Churu (31.82 %), the Chloride content is beyond the permissible limits.

9. **Sulphate:** 47.14 % samples fall within acceptable limit, 24.13 % within acceptable and permissible limit and 28.7 % samples are beyond permissible limit of BIS guidelines for drinking water. In Barmer (59.26 %), Nagaur (56.41%), Dausa (40%), Hanumangarh(37.50%), Pali (36.84%) and Jodhpur 34.72% districts water samples have Sulphate value beyond permissible limit (400 mg/l).

10. **Nitrate:** It is found that 50.32 % of the samples, have Nitrate content below the permissible limit and 49.68 % sample having Nitrate content beyond the permissible limits. Maximum value of 1180 mg/l of Nitrate content in ground water is observed at Shawa in Churu district. In ditricts of Pratapgarh (85.71 %) , Barmer (66.67%) Churu and Karauli (63.64 %) each , Baran and Chittaurgarh 60.0 % each , Banswara and Tonk 57.14 % each , Jodhpur 56.94% , Hanumangarh and Jaipur 56.25% each , Sikar and Udaipur 50% each Nagaur 48.72%, Bhilawara 48.15%, Jalore 47.83% Pali 47.37% Ganganagar and Sawaimadhopur 45.45% each , Ajmer 42.86% and Alwar 40% having more than permissible limit nitrate value.

11. **Fluoride :** Occurrence of high Fluoride in the ground water is a great concern as 38.73 % samples have Fluoride in desirable range, 17.62 % in the permissible and the remaining43.65 % have fluoride above 1.50 mg/L. Map showing spatial distribution (Figure 7) of Fluoride contents in ground water indicates that ground waters with fluoride above 1.50 mg/L are found mainly in Pali 73.68 %, Jalore 69.57%, Nagaur 66.67% jhunjhunu 63.16% , Sirohi 61.54 % , Jodhpur 61.11 % Jaipur 53.11 %, , Churu 47.53% , Jaisalmer 45.45%, Sawaimadhop[ur 45.45% and ajmer and Banswara 42.86 % each Barmer 42.59 % and Chittorgarh 40% districts of the State. Out of 630 samples analysed, 17.40 % samples are within Acceptable limit of 200 mg/ l for total hardness. 26.80 % samples have concentration beyond permissible limit while 56.03 % samples fall within acceptable and permissible limits. Total hardness above 600 mg/l is found in Hanumangarg (43.75%), Nagaur (43.59%), Bharatpur (40.00%), Churu(38.64%),Bhilwara

(37.04 %), Gaanganagar, (36.36 %), Jodhpur (30.56%),Jalore (30.43%), districts have Total Hardness concentration beyond permissible limit.

12. In the State, no specific trend for concentration of particular trace element/heavy metals in groundwater is observed. However, Arsenic, Cadmium, and Zinc are within acceptable drinking water limits in study area. And Manganese is found to be present at many places though mostly in low concentrations. A few wells (2.66 %) located in Alwar, Bharatpur, Bhilwara, Chittaurgarh & Dausa have manganese values between the acceptable(0.1mg/l) and permissible(0.3mg/l)limitsof BIS for drinking water . It is found to range from below detection limit to high concentration 0.14 mg/l at Bhagli In Jalore district . About 6.66 % of the wells have recorded more than 0.01mg/l of lead (Pb). Such waters are found in parts of Alwar, Barmer, Bharatpur, Churu, Dhalpur, Hanumangarh, Jaisalmer, Nagaur and Sawaimadhopur one location each and Jalore(3- locations) and Jodhpur(2-locations.) The concentration of Iron in ground water of the State ranges from below detection level to 2.267 mg/l (Hurda, district Bhilwara). Most of the shallow water samples have iron content within the acceptable limit of 1.0mg/l, only about 3.55% water wells recorded its concentration more than more thanacceptable limit 1.0mg/l.

13. Out of 630 samples where Uranium concentration above 0.030 mg/l is observed in 21 districts out of 33 districts of Rajasthan state ((21.27%) .Most of locations in 10 districts where more than four locations where >30 ppb uranium were found namely Jodhpur , Jaipur, Nagaur, Tonk, Bikaner, Bharatpur, Ganganagar, Churu & remaining 11 districts having one to three locations where more than 30 ppb uranium were found namely Alwar, , Dausa, Hanumangarh, Jaisalmer, Jalore, Jhunjhunu, Karauli, Rajshamand, Swai Madhopur, Sikar and Bhilwara. Districts having greater than 30 ppb uranium in ground water are primarily associated with alluvial aquifer.Elevated levels of uranium in ground water of unconfined alluvium aquifers may be due to redox rections which controls the solubility.

14. In general, we can classify the sample points in the piper diagram into 5 fields. They are 1. Ca-HCO_3 type, 2. Ca-Mg- Cl type, 3. Na-Cl type, 4. Na-HCO_3 type and 5. Mixed type. In Piper diagram comprising the 16 districts that covers the northern and eastern and some central part of Rajasthan state, majority of the samples (62%) are plotted in the Na-Cl field and 25 % of the samples showed Ca-HCO_3 type. Rest of them was fall in the Ca-SO_4 and Mixed water types Whereas, the second Piper plot that covers the western, central and some southern part of Rajasthan state, majority of samples around 75% fall in Na-Cl type and Ca-SO4-Cl water types. Only 15% samples having fresh water quality that shown the Ca-HCO_3 water type may be due to recharge zone on southern districts that is Pratapgarh, Rajsamand and Udaipur.

15. USSL diagram shows that most of the water samples fall in the category C2S1, C3S1, C3S2 and C4S3 and C4S4 indicating medium to very high salinity and sodicity. C2S1, C3S1, C3S2 and C4S2 category water is used for plants with good salt tolerance and C3S3, C4S3 Category water can also used after proper treatment. Category C4S4 is not suitable for agriculture activity.

16. SAR values is varies to excellent to good type of water for agriculture in study area and much better quality in post monsoon season. Most of water or more than 73.40 % sample location is suitable for agriculture activity.14.40 % locations water is used after proper treatment. Only 12.20 % locations water is not suitable for agriculture activities.

17. Water quality index value for drinking and Domestic use is indicating that 51.43 % samples belong to the Class I & II category, representative that the water is good to excellent quality. While it can also be inferred that about 7.14 % water samples were unsuitable for drinking purpose.

The overall probable causes of ground water quality deterioration in Rajasthan State are due to natural hydro- geological conditions, population pressure, over exploitation of ground water, lack of harvesting of rainfall for recharge of ground water, improper disposal of municipal and industrial solid waste and lack of public awareness, inadequate measure for rain water harvesting. Recommendations based on the ground water survey study have been presented at the end of the report. Areas identified with unsuitable or marginally suitable water quality should be monitored on micro level to effectively delineate such areas and use.

1.0 INTRODUCTION

The Rajasthan State comprising of 33 districts has a geographical area of 3, 42, 239 square kilometre (sq km) and is the largest state in the country. It is situated between north latitudes 23^0 03' and 30^0 12' and east longitudes 69^0 30' and 78^0 17 '.

Rapid population increase coupled with agricultural practices, urbanization and industrialization has brought in many interventions in the State of Rajasthan. This has resulted in both ground water and surface water pollution over space and time Water quality problem has posed serious health hazards and people are affected by various water borne diseases. To mitigate this problem, various Central and State departments, R&D institutions are actively engaged in water quality assessment and monitoring.

The administrative map of Rajasthan is shown in Plate-I

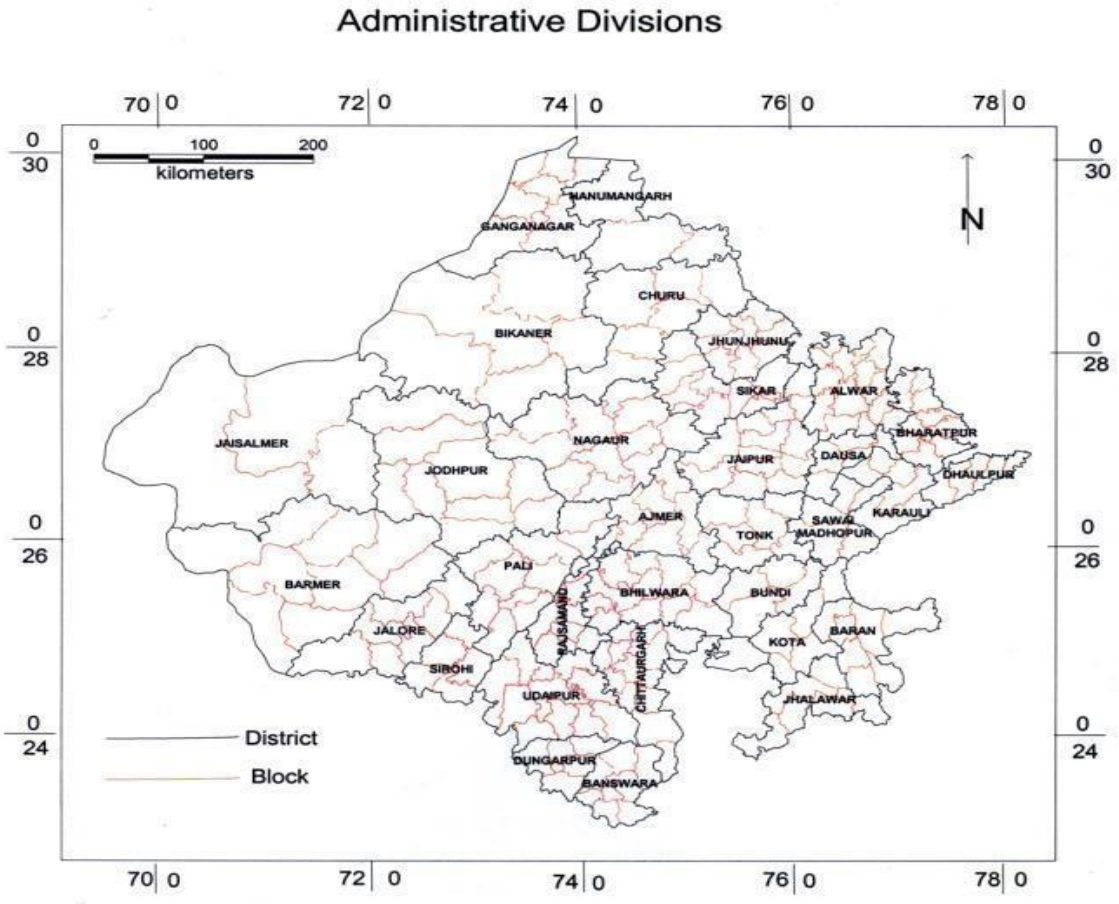


Plate-I

The economy of Rajasthan is the ninth-largest state economy in India and is primarily agricultural and pastoral. Wheat and barley are cultivated over large areas, as are pulses, sugarcane, and oilseeds. Cotton and tobacco are the state's cash crops. Rajasthan is among the largest producers of edible oils in India and the second largest producer of oilseeds. Rajasthan is also the biggest wool-producing state in India and the main opium producer and consumer. There are mainly two crop seasons. The water for irrigation comes from wells and tanks. The Indira Gandhi Canal irrigates northwestern Rajasthan.

The main industries are mineral based, agriculture-based, and textile based. Rajasthan is the second largest producer of polyester fibre in India. Several prominent chemical and engineering companies are located in the city of Kota, in southern Rajasthan. Rajasthan is pre-eminent in quarrying and mining in India. The state is the second largest source of cement in India. It has rich salt deposits at Sambhar, copper mines at Khetri, Jhunjhunu, and zinc mines at Dariba, Zawar mines and Rampura Agucha (opencast) near Bhilwara. Dimensional stone mining is also undertaken in Rajasthan. Jodhpur sandstone is mostly used in monuments, important buildings, and residential buildings. Jodhpur leads in Handicraft and Guar Gum industry. Rajasthan also has reserves of low-silica limestone. It is sevent largest state of India by population and Jaipur remains the most populous city of Rajasthan.

The quality of groundwater in Rajasthan is a matter of concern given the high salinity and over exploitation of groundwater. The present report is an effort to understand status groundwater quality in the Rajasthan State with special reference to trace elements with an aim to understand the cause of contamination of groundwater, if any

A network of ground water monitoring stations is distributed all over the State and spatially presented in Plate–II. These stations are periodically monitored for ground water regime behaviour viz. recording of water level, temperature and collection of water samples for chemical quality assessment (once in a year i.e. in the month of May).

In the background of this, to evaluate the intensity of industrial pollution and its impact on ground water quality in industrial clusters of Bhiwadi, Jaipur and Jodhpur have been taken up during the past few years by CGWB,WR.

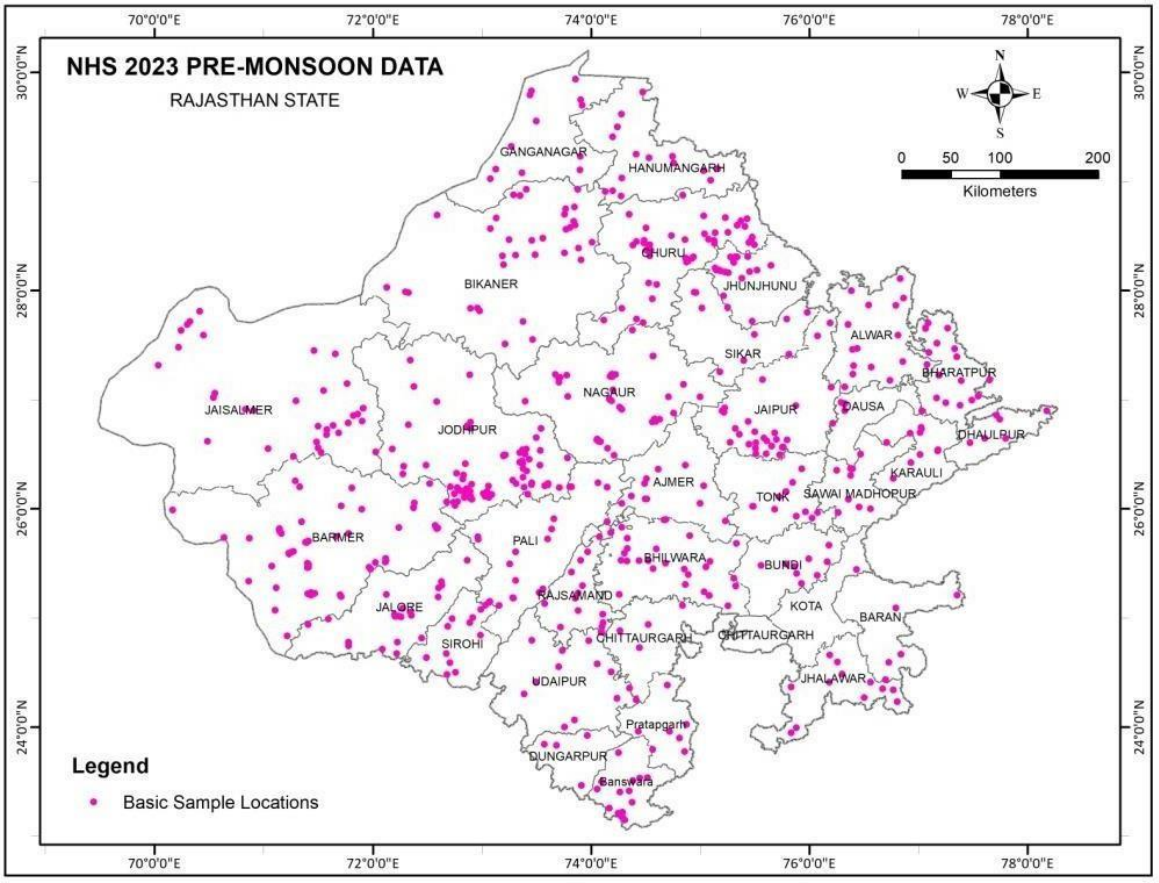


Plate-II- **Map showing Spatial Distribution of Groundwater Quality Monitoring Stations in based on 2023 NHS**

2.0 AIMS AND OBJECTIVES

Ground water is extensively used for drinking, irrigation and industrial activities in Rajasthan. Suitability of ground water for these uses depends on its ambient quality that is reflected in the concentrations of chemical constituents present in it at that time. As the composition of ground water is dependent on various geo-hydrological and environmental factors, the resultant chemical quality of ground water varies in time and space. For its optimal utilization for intended uses, it is imperative to assess the ambient quality of regional ground water.

The common belief that groundwater is of better quality as compared to surface water quality does not hold good at all times at all places. Recently, researchers have reported different types of pollutants in shallow ground waters at variouslaces and the onus has been placed on the pollution of the overall environment (air, soil, and water) as a whole.The pollution of the environment is undoubtedly associated with rapid increase in population, industrialization and agricultural growth, as progress in civic amenities

normally lags behind than necessary.Over exploitation of ground water to meet the rising demand for fresh water for human use has also contributed towards pollution levels of ground water.

One of the pollutants of major concern is the 'hazardous metal ion' also referred in scientific literature as 'Heavy Metal' due to their specific density being above 5.They are also termed as 'Trace Elements' because of their occurrences in low quantities in natural sources. Almost all the trace elements are toxic at higher concentration; some of them are toxic at low levels and few others are toxic even in trace amounts. CGWB, WR, Jaipur monitors the ground water quality annually through network of hydrograph stations consisting of dug wells and/or HP of shallow depth.

The quality of groundwater in Rajasthan is a matter of concern given the high salinity and over exploitation of groundwater. The present report is an effort to understand present status of ground water quality in the Rajasthan State and an aim to understand the cause of contamination of groundwater, if any Status of ground water quality of Rajasthan state report has been prepared on the basis of chemical data generated from the analysis of ground water samples, collected during May 2023-24 from shallow wells GWMS.

3.0PHYSIOGRAPHIC FEATURES

3.1Topography

The state has a fairly mature topography developed during the long period of denudation and erosion. The present physiography and landforms are greatly determined by geological formations and structures and is the product of the past fluvial cycle of erosion and the recent & continuing desert cycle of erosion. The Physiographical map of Rajasthan is shown in Plate-III.

Physiographically the state can be divided into four units:

(a) Aravalli hill ranges (b) Eastern plains

© Western Sandy Plain and Sand Dunes

(d) Vindhyan Scarpland and Deccan Lava Plateau

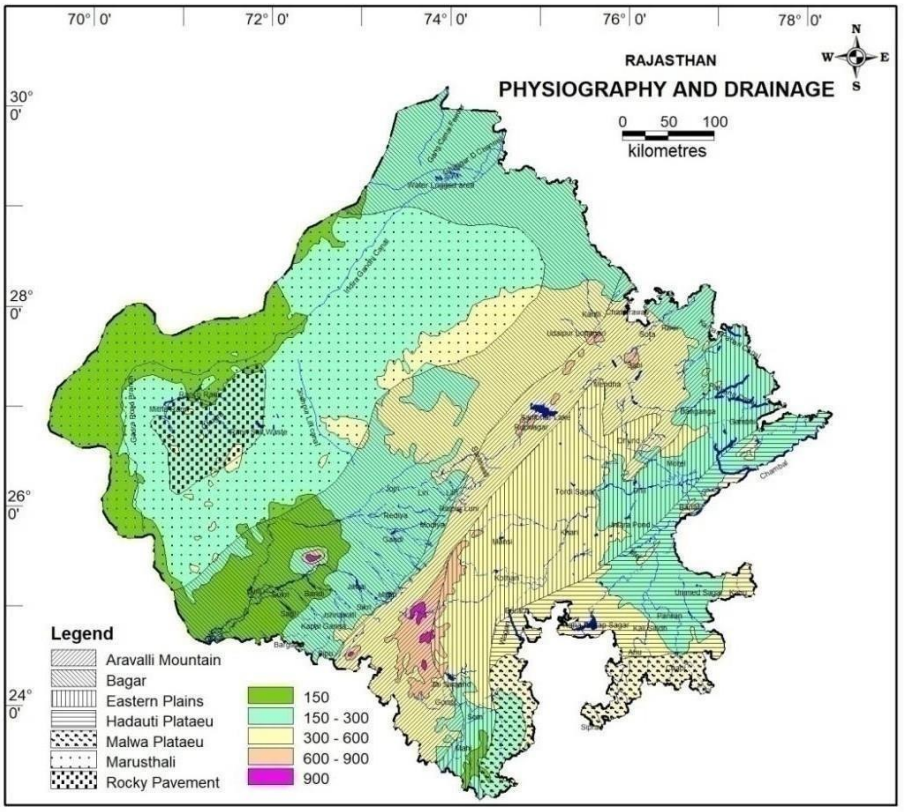


Plate-III : Physiographical map of Rajasthan

3.2 Drainage

The Aravalli Hill Ranges from the main water divide in Rajasthan. Luni is the only river westof Aravallis. In the remaining area of western Rajasthan comprising about 60% of the geographical area of the state, the drainage is internal, and the streams are lost in the desert sands after flowing for a short distance from the point of origin. Luni itself essentially is an ephemeral stream with flood cycle of 16 years. Drainage in western Rajasthan istowardswest and south - west. In the east of Aravalli ranges the main drainage is towards north - east.The other important catchments include Yamuna-Ganga in the north east, and Mahi and Sabarmati in the south west with flow towards south. The former three catchmentssupport perennial rivers. In the northern and north-eastern parts of eastern Rajasthan, the Banganga, Barah, Sota, Sahib and Kantli rivers are of inland nature. The drainage in the BISle of Rajasthan is generally dendritic.

In the desert area a few salt lakes and depressions exist, prominent among them being the Sambhar Lake, Didwana Lake, Bap, Pachpadra and Rann of Jaisalmer and Pokhran.

4.0 CLIMATE AND RAINFALL

Rainfall is the major source of ground water recharge in the state. The state receives 90

% rainfall from south west monsoon from June to September. The winter rainfall is meagre. Map showing distribution of average annual rainfall during 2022 in the State (Figure 4).

There are 349 Rain gauge stations in the state. The annual rainfall data of ten years 2012 to 2022 have been analysed to calculate average rainfall of each district in the respective years. The average annual rainfall of the state during the period 2022 works out to be 643.9 mm.

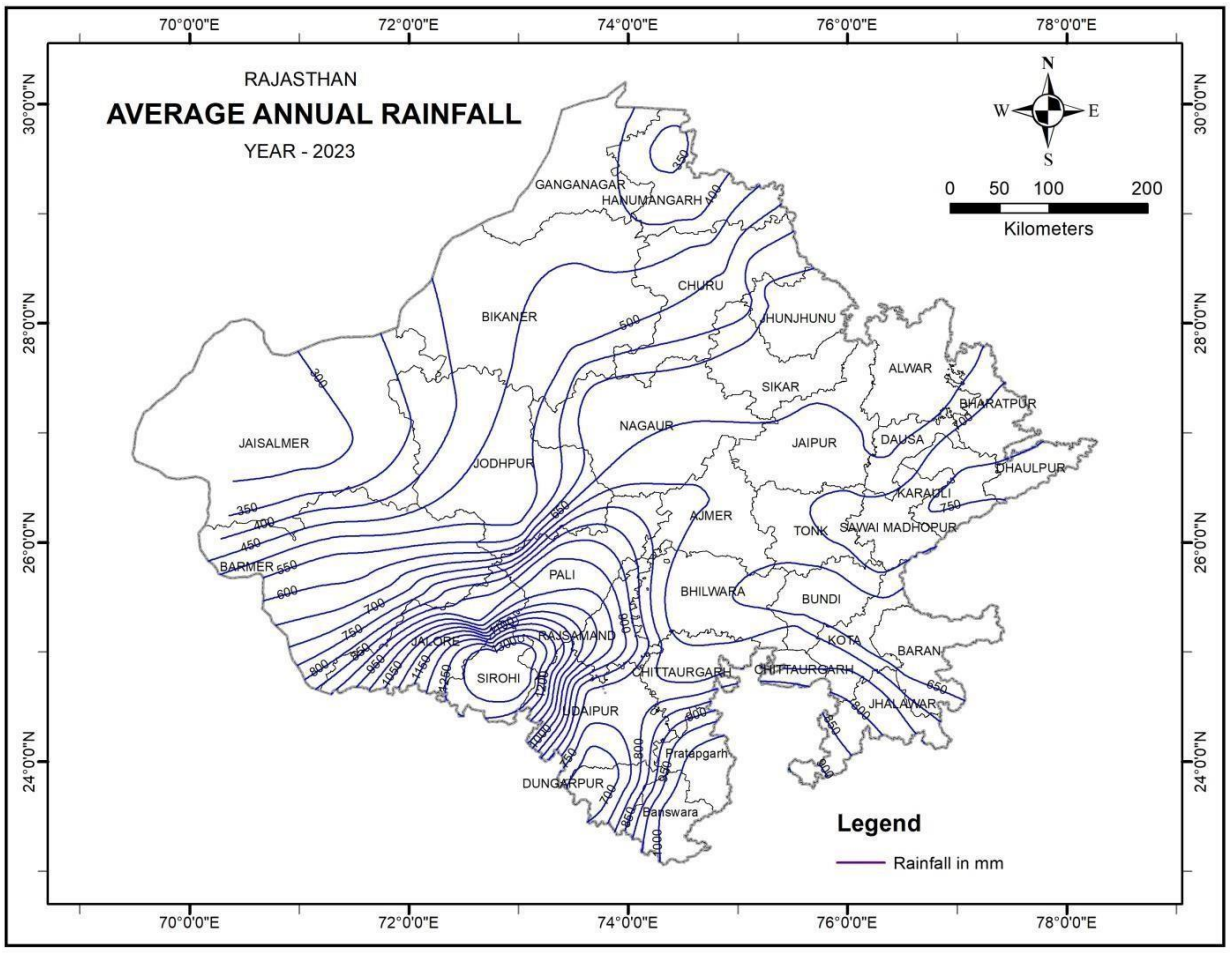


Plate-IV : Distribution of average annual rainfall

The average annual rainfall and departures (%) from normal annual rainfall in the state is shown in plate-IV. The percentage departures of average annual rainfall from Normal (1901-70) have been computed for the last ten years and tabulated in Table 1. It is observed that the average annual rainfall in the State, during the year 2022 is 29.5% more than the normal annual rainfall. The average annual rainfall in the state was more than 21.2% of average (2013-22) rainfall. Annual Rainfall and Departure from Normal is shown in plate-V.

Table 1: : Average Annual Rainfall and Departure (%) From Normal Rainfall.

S. No.	District	Normal (1901-70)	Average rainfall (2014-23) (mm)	Rainfall - 2023 (mm)	Departure (%) in 2023 from normal rainfall	Departure (%) in 2023 from Average rainfall
1	Ajmer	437	550.93	701	37.67	21.42
2	Alwar	626	554.22	606	-3.36	8.49
3	Banswara	870	939.14	1031	15.60	8.90
4	Baran	895.3	980.70	605	-47.95	-62.06
5	Barmer	260	359.95	583	55.40	38.25
6	Bharatpur	675.1	609.71	718	6.01	15.11
7	Bhilwara	603.3	662.33	659	8.41	-0.55
8	Bikaner	249.8	338.24	460	45.68	26.45
9	Bundi	715.8	790.68	621	-15.19	-27.24
10	Chittorgarh	772.3	876.38	722	-6.98	-21.40
11	Churu	337.9	458.72	513	34.17	10.63
12	Dausa	625.7	636.94	644	2.89	1.14
13	Dhaulpur	717.5	653.17	761	5.73	14.19
14	Dungarpur	610.4	806.38	662	7.82	-21.78
15	Ganganagar	171.6	270.72	417	58.82	35.04
16	Hanumangarh	237.5	320.78	344	31.03	6.85
17	Jaipur	526.8	580.44	665	20.73	12.65
18	Jaisalmer	158.6	248.28	282	43.81	12.04
19	Jalore	400.6	562.33	873	54.14	35.62
20	Jhalawar	884.8	1,092.53	782	-13.09	-39.64
21	Jhunjhunu	459.5	500.01	620	25.88	19.35
22	Jodhpur	296.7	391.61	488	39.24	19.80
23	Karauli	616.2	614.08	754	18.32	18.60
24	Kota	808.7	871.84	706	-14.48	-23.42
25	Nagaur	363.1	504.78	626	41.97	19.32
26	Pali	484.5	636.93	911	46.80	30.06
27	Pratapgarh	806	1,129.34	1022	21.14	-10.49
28	Rajsamand	556.1	725.22	947	41.30	23.45
29	Sawai Madhopur	655.8	783.51	734	10.60	-6.81
30	Sikar	459.8	555.90	623	26.18	10.75
31	Sirohi	606.3	812.78	1370	55.75	40.68
32	Tonk	598.2	792.00	715	16.31	-10.80
33	Udaipur	630.7	741.75	780	18.87	4.88
RAJASTHAN		**549.1**	**647.04**	**695**	**20.9**	**6.95**

A perusal of Figure 5 reveals that the rainfall in the east of Aravalli is significantly higher as compared to the western part.

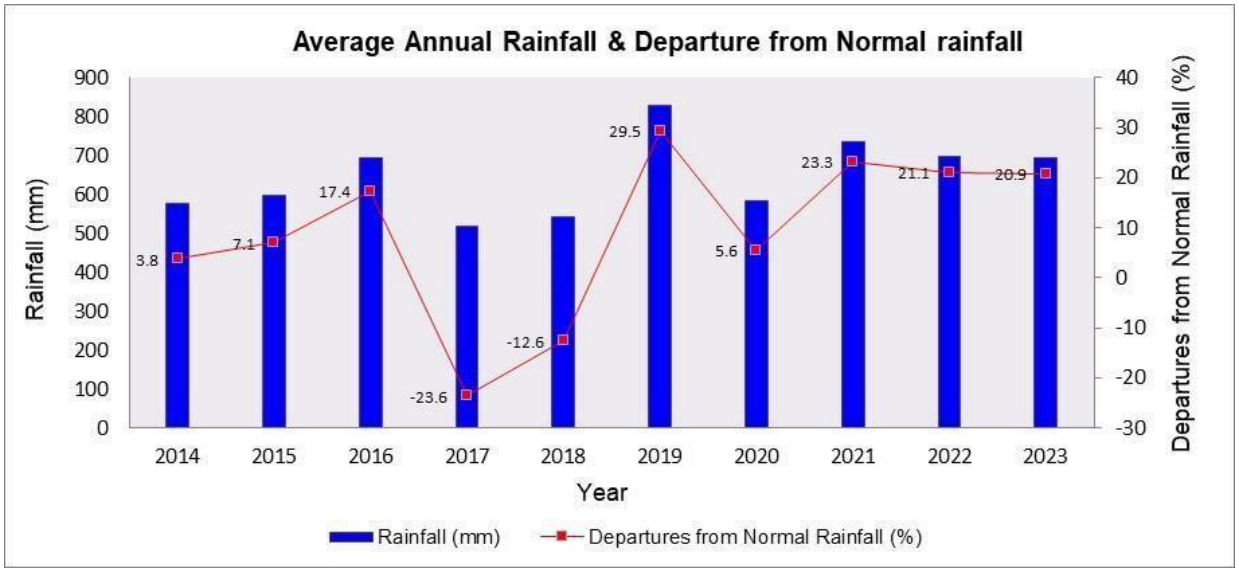


Plate-V : Annual Rainfall and Departure from Normal

4.1 Temperature

The hot weather season commences in the month of March and continues through April to June. In the month of May the diurnal range of temperature increases more and the day become hotter. During June the mean maximum temperature reaches as high as 48° C.

January is the coldest month. The normal minimum temperature (January) range from 2°C in the north to 7.8°C in south. At Mount Abu (1195 m AMSL), temperature dips to freezing point during the month of December/January. In eastern Rajasthan the range of normal minimum temperature (January) in and around the Aravalli hill ranges is 7°C to 8°C which increases towards the east and attains a high of more than 10°C in the districts of Kota and Bundi.

Climatically, the year in Rajasthan can be divided into three major conventional seasons as follows:

The Hot- Weather Season (March to end of June) Monsoon Season (End of June to September) The Cold- Weather Season (October to February)

5.0 GEOLOGY

Diverse rock types ranging from the oldest Archaean rocks to sub- Recent alluvium andwind-blown sand are exposed in Rajasthan. In a major portion of the area, particularly inwestern Rajasthan, the oldest rocks are concealed below a thick cover of alluvium and wind-blown sands. A generalised stratigraphic succession of various formations and rock types is given in

Table 2: Geological Succession

GEOLOGICALTIMEUNIT		LITHOSTRATIGRAPHICTIMEUNIT		LITHOLOGY
ERA	PERIOD	SUPERGROUP/GROUP		
RECENT				Alluviumandblown sand
CAINOZOIC(TERTIARY)	Eocene	Mandai/Akli/Kapurdih/Jogira/Banda/Khuiala /Palana		Sandstone,bentoniticclay&fuller' searth
DECCANTRAPS				Basalt
MESOZOIC	Cretaceous	Abur/Fatehgarh		Sandstone,limestone,clayandlign ite
	Jurassic	Paruhar/Bhadesar/Baisakhi/Jaisalmer/Lath i		Limestone,sandstone& shale
PALAEOZOIC	Permo- Carboniferous		Bhadura	Sandstone& boulders
		Marwar	Nagaur/ Bilara/Jodhpur	Sandstone, gypsum, siltstone,limestone,dolomite &shale
UPPERPROTEROZOIC		Vindhyan	Bhander/Rewa/Kaimur/ Semri	Sandstone, shale, limestone,conglomerate&basicflows
		Acid,BasicandUltrabasicIntrusivesandExtrusivesMalaniVolcanics/Plutonics Kishangarh Syenite		
LOWERPROTEROZOIC		Delhi	Ajabgarh/Alwar/Sirohi/ Punagarh/Raialo	Quartzite, schist, gneiss, marble,shale,slate,phyllite&basic flows
		Granite,Basic& UltrabasicIntrusives		
		Aravalli	Jharol/ Bari/ Udaipur/Debari	Quartzite, schist, phyllite, conglomerate, greywacke,metavolcanics&marble
		Granite& BasicIntrusives		
ARACHAEAN		Bhilwara	Ranthamobre/ Rajpura-Dariba /Hindoli	Phyllite,slates,schist,gneiss,granitegneiss& migmatites

The various lithological units have been classified into two groups on the basis of their degree ofconsolidation and related parametres these are:

I Porous formations - a) Unconsolidated formations b) Semi- consolidated formations, *II Fissured formations*- Consolidated sedimentary rocks, b) Igneous and metamorphic rocks, c) Volcanic rocks d) Carbonate rocks

6.0 HYDROGEOLOGY

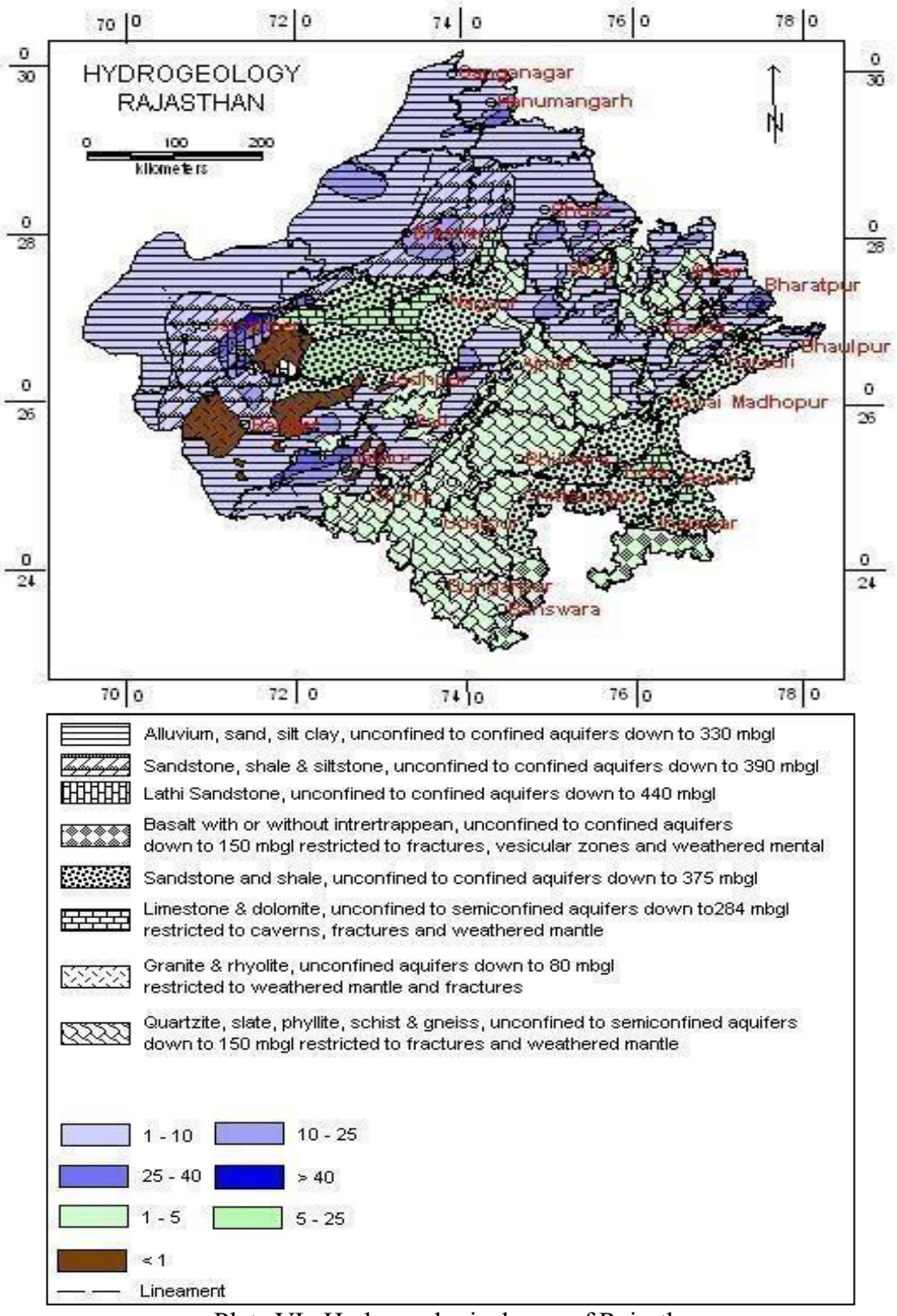


Plate VI : Hydrogeological map of Rajasthan

The hydrogeological map of Rajasthan is shown in Plate-VI. The rincipal sourceof recharge to ground water in Rajasthan is rainfall.In canal irrigated areas, apart of canal water through seepage from conveyance system and part of water i.e. utilised for irrigation also returns to ground water and contributes to storage.

7.0 DEPTH TO WATER LEVEL (UnconfinedAquifer)-

Total number of wells analysed are 832. A perusal of map (Fig-3) and Table III of annual water level fluctuation from May, 2022 to May, 2023 reveals that 55.65% stations shown rise, 43.63% decline &

<1% stations shows no change in water level. Area of rise in water spreads from south east to south- central, north western, western and west central parts of the State. Minimum & maximum rise was recorded 0.01m in (Jaisari, Bharatpur and Bhavanipura Deep, Jaisalmer District) and 22.78 m (Tuli Deep, Jaisalmer district).

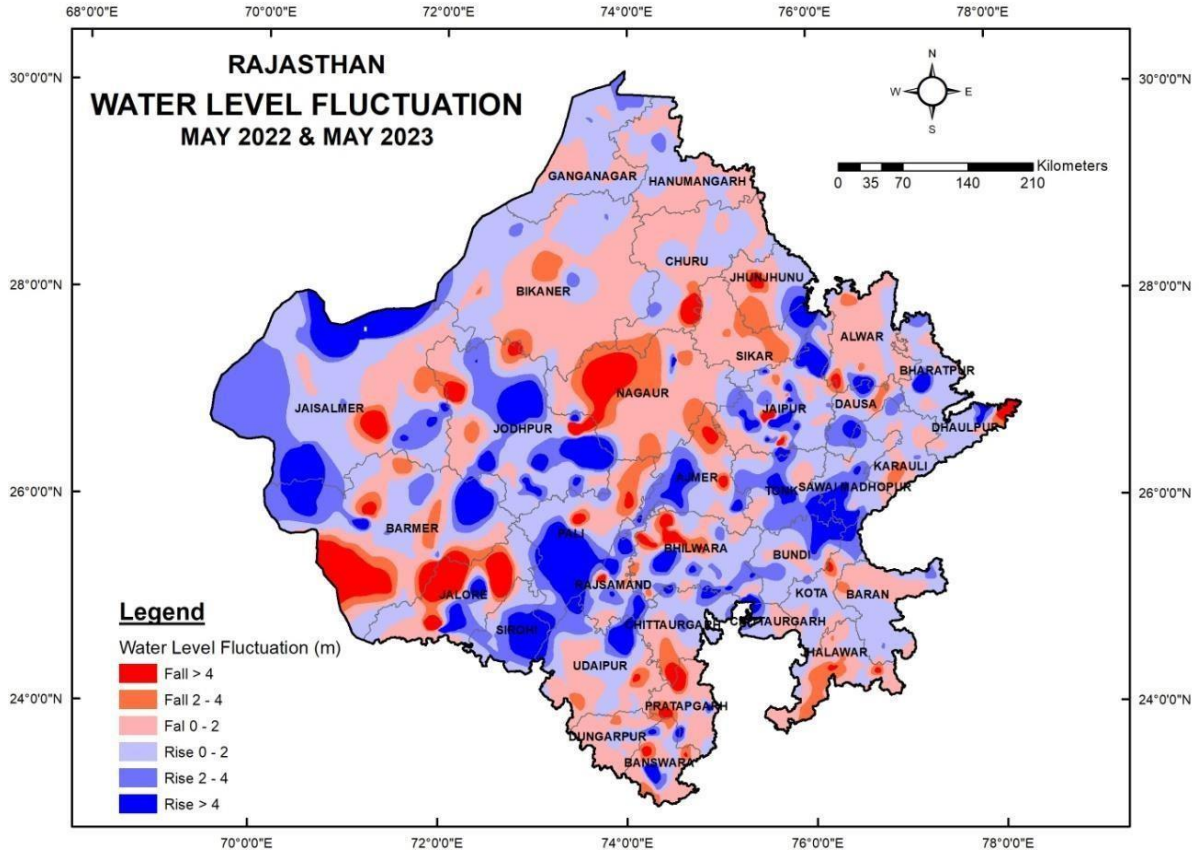


Plate VII : **Water Level Fluctuation – May 2022 to May 2023**

Rise in water level < 2m in 31.1% stations was observed falling mostly in Ganganagar, Baran, Jaisalmer, Bharatpur, Kota, Dausa, Dholpur, Hanumangarh, Churu, Chittrogarh, Karauli, Bhilwara, Bikaner, Udaipur, Sawai Madhopur, Jalore, Barmer, Alwar, Jhalawar, Jodhpur, Ajmer & Jaipur districts and at isolated locations in all the remaining districts.

Water level rise between 2 & 4m was shown by 11.8% stations mostly falling in Sirohi, Rajsamand, Kota, Jaipur & Barmer districts and at isolated patches in Ajmer, Bhilwara, Karauli, Jodhpur, Baran, Sawai Madhopur, Tonk, Udaipur and Bundi districts.

Rise of more than 4m has been recorded at 12.7% stations falling mostly in Tonk, Sirohi, Pali, Ajmer, Rajasmand, Sawai Madhopur & Jalore districts and at isolated locations in Jodhpur, Bundi, Jaipur, Dausa, Dholpur, Nagaur, Bhilwara, Barmer & Banswara districts.

About 43.63% stations scattered in all the districts, mostly in north-eastern, south, south weastern, north& north central parts, shows decline in water level during this period. Minimum & maximum decline was recorded at 0.01 m in (Godu, Bikaner; Lalgariya, Gangangar; Ganeshpura, Jhalawar; Ghana Magra, Jodhpur & Dewas, Sikar district) and 33.30 m (Palari, Jodhpur district).

Decline in water level <2m was recorded in 32.8% stations falling mostly in Sikar, Dungarpur, Jhunjhunu, Pratapgarh, Bundi, Hanumangarh, Alwar, Churu, Nagaur, Banswara, Bharatpur, Jhalawar, Bikaner, Chittorgarh, Karauli, Udaipur, Tonk & Ganganagar districts and at isolated locations in all districts except Sirohi district.

Decline in water level between 2 & 4m was recorded at 5.6% stations at scattered locations in Nagaur, Banswara, Dausa, Jhalawar, Jhunjhunu & Pali Districts.

Water level decline>4m was exhibited by 5.2% stations at scattered locations in Pali, Sirohi, Jalore, Jhunjhunu, Pali, Bhilwara and Dholpur districts.

8.0 GROUND WATER QUALITY SCENARIO OF THE STATE -

Natural quality of ground water is dependent on geological characteristics and climatic conditions. It is further influenced and generally degraded by human activities. Indiscriminate extraction of groundwater for day to day uses, application of fertilizers in agriculture and unscientific disposal of industrial waste have great impact on ground water quality. The quality of ground water is normally ascertained through concentration values of number of physical, chemical and biological parameters present in it. Concentration of these parameters affects its acceptability and usefulness for domestic, agriculture, industrial and other purposes. It is, therefore, essential to know the chemical composition of ground water to determine its suitability for the intended use. Knowledge of quality of ground water not only helps in finding its suitability for various purposes, but it also helps in taking effective remedial measures for its improvement on scientific lines. In rural as well as in urban area of Rajasthan State, ground water is a major resource for drinking and other uses. Wherever surface water is inadequate or unavailable, ground water is exploited for drinking and irrigation purposes. In the backdrop of various uses of ground water, its quality is monitored annually by CGWB, WR Jaipur, through dedicated ground water monitoring stations (GWMS) of dug wells and/or HPs of shallow depth.

8.1Hydrochemistry ;

Hydrochemistry is an interdisciplinary science that deals with the chemistry of water in the natural environment. Professional fields such as chemical hydrology, aqueous chemistry, hydrochemistry, water chemistry and hydro-geochemistry are all more or less synonyms. The classical use of chemical characteristics in chemical hydrology is to provide information about the regional distribution of water qualities. At the same time, hydrochemistry has a potential use for tracing the origin and history of water. The hydrochemistry can also be of immense help in yielding information about the environment through which water has circulated. Hydrochemistry can be helpful in knowing about residence times, flow paths and aquifer characteristics as the chemical reactions are time and space dependent. It is essential to study the entire system like atmospheric water (rainwater), surface water and ground water simultaneously in evaluating their hydrochemistry and pollution effect.

8.2 Chemistry of Rainwater

The atmosphere is composed of water vapors, dust particles and various gaseous components such as N_2, O_2, CO_2, CH_4, CO, SO_4, NO_3 etc. Pollutants in the atmosphere can be transported long distances by the wind. These pollutants are mostly washed down by precipitation and partly as dry fall out. Composition of rainwater is determined by the source of water vapors and by the ion, which are taken up during transport through the atmosphere. In general, chemical composition of rainwater shows that rainwater is only slightly mineralized with specific electrical conductance (EC) generally below 50 □S/cm, chloride below 5 mg/l and HCO_3 below 10 mg/l. Among the cations, concentration of Ca, Mg, Na & K vary considerably but the total cations content is generally below 15 mg/l except in samples contaminated with dust. The concentration of sulphates and nitrates in rainwater may be high in areas near industrial hubs.

8.3 Chemistry of Surface Water

Surface water is found extremely variable in its chemical composition due to variations in relative contributions of ground water and surface water sources. The mineral content in river water usually bears an inverse relationship to discharge. The mineral content of river water tends to increase from source to mouth, although the increase may not be continuous or uniform. Other factors like discharge of city wastewater, industrial waste and mixing of waters can also affect the nature and concentration of minerals in surface water. Among anions, bicarbonates are the most important and constitute over 50% of the total anions in terms of milli equivalent per liter (meq/l). In case of cations, alkaline earths or normally calcium predominates but with increasing salinity the hydrochemical facies tends to change to mixed cations or even to Na-HCO_3 type.

8.4 Chemistry of Ground Water

The downward percolating water is not inactive, and it is enriched in CO_2. It can also act as a strong weathering agent apart from general solution effect. Consequently, the chemical composition of

ground water will vary depending upon several factors like frequency of rain, which will leach out the salts, time of stay of rain water in the root-zone and intermediate zone, presence of organic matter etc. It may also be pointed out that the water front does not move in a uniform manner as the soil strata are generally quite heterogeneous. The movement of percolating water through larger pores is much more rapid than through the finer pores. The overall effect of all these factors is that the composition of ground water varies from time to time and from place to place

Before reaching the saturated zone, percolating water is charged with oxygen and carbon dioxide and is most aggressive in the initial stages. This water gradually loses its aggressiveness, as free CO_2 associated with the percolating water gets gradually exhausted through interaction of water with minerals.

$$CO_2 + H_2O \longleftrightarrow H_2CO_3 \longleftrightarrow H^+ + HCO_3^-$$

$$H^+ + \text{Feldspar} + H_2O \longrightarrow \text{Clay} + H_4SiO_4 + \text{Cation}$$

The oxygen present in this water is used for the oxidation of organic matter that subsequently generates CO_2 to form H_2CO_3. This process goes on until oxygen is fully consumed.

$$CH_2O + O_2 = CO_2 + H_2O$$

(Organic matter)

Apart from these reactions, there are several other reactions including microbiological mediated reactions, which tend to alter the chemical composition of the percolating water. For example, the bicarbonate present in most waters is derived mostly from CO_2 that has been extracted from the air and liberated in the soil through biochemical activity. Some rocks serve as sources of chloride and sulphate through direct solution. The circulation of sulphur, however, may be greatly influenced by biologically mediated oxidation and reduction reactions. Chloride circulation may be a significant factor influencing the anion content in natural water.

8.5 Water Quality Criteria :

The available quality of groundwater is the resultant of all the processes and reactions, which taken place since the condensation of water in the atmosphere to the time it is retrieved in the form of groundwater from its source. The water has excellent capability to accumulate substances in soluble form as it moves over and into the land resource, from the biological processes and from human activities. Urbanization, agricultural development and discharges of municipal and industrial residues significantly alter characteristics of groundwater resource. The prevailing climatic conditions,

topography, geological formations and use and abuse of this vital resource have significant effect on the characteristics of the water, because of which its quality varies with locations.

The definition of criteria and standards for water quality vary with the type of use. The characteristic of water required for human consumption, livestock, irrigation, industries etc., have different water quality requirements. The term water quality criteria may be defined as the "Scientific data evaluated to derive recommendations for characteristics of water for specific use'. The term standard applies to any definite rule, principle or measure established by any statutory Authority. The distinction between criteria andstandards is important, as the two are neither interchangeable nor they become synonyms for the objective or goal. Realistic standards are dependent on criteria, designated uses and implementation as well as identification and monitoringprocedure. The changes in all these factors may provide a basis for alteration instandards. In formulation of water quality criteria, the selection of water quality parameters depends on its use. Sayers, et. al. (1976 as quoted in CGWB & CPCB 2000) identified the key water quality parameters according to its various uses (Table 3.0)

Table 3.0: Water quality criteria parameters for various uses (Sayers et.al., 1976)

Public Water supply	**Industrial Water supply**	**Agricultural water supply**	**Aquatic life & wild life water supply**	**Recreation and Aesthetics**
Coliform bacteria Turbidity colour, Taste, Odour TDS, CI, F, SO_4 NO_3, CN, Trace Metals, Trace Organics Radioactive substances	**Processing** pH, Turbidity Colour, Alkalinity, Acidity, TDS, Suspended solids, Trace metals, Trace Organics **Cooling** PH, Temp, Silica, AI, Fe, Mg, Total hardness, Alkalinity / Acidity Suspended solids, Salinity	Farmstead Same as for public supply Live-stock Same as for public supply Irrigation TDS, EC, Na, Ca, Mg, K, B, CI and Trace metals	Temp, DO, pH, Alkalinity, Acidity, TDS Salinity, pH, DCOs, Turbidity Colour, Settleable materials, Toxic substances, Nutrients, Floating materials	Recreations Tem, Turbidity, Colour, Odour, Floating Materials, Settable Materials Nutrients, Coliforms Aesthetics Same as for Recreation and Substances adversely affecting wild life

Water Quality Criteria for Drinking Purpose

With the objective of safeguarding water from degradation and to establish a basis forimprovement in

water quality, standards / guide lines / regulations have been laid downby various national and international organizations such as; Bureau of Indian Standards(BIS), World Health Organization (WHO), European Economic Community (EEC), Environmental Protection Agency (EPA), United States, and Inland Waters Directorate, Canada. The Bureau of Indian Standards (BIS) earlier known as Indian Standards Institutions (ISI) has laid down the standard specification for drinking water during 1983, which have been revised and updated from time to time. In order to enable the users, to exercise their discretion towards water quality criteria, the maximum permissible limit has been prescribed especially where no alternative sources are available. The national water quality standards describe essential and desirable characteristics required to be evaluated to assess suitability of water for drinking purposes. The important water quality characteristics as laid down in BIS standard (IS 10500: 2012) are summarized in **Table - 4**

Table 4: Drinking Water Characteristics (IS 10500: 2012)

S. No.	Parameters	Desirable Limits (mg/L)	Permissible limits (mg/L)
Essential Characteristics			
1	Colour Hazen Unit	5	15
2	Odour	Unobjectionable	-
3	Taste	Agreeable	-
4	Turbidity (NTU)	1	5
5	pH	6.5-8.5	No relaxation
6	Total Hardness, $CaCO_3$	200	600
7	Iron (Fe)	1.0	No relaxation
8	Chloride (Cl)	250	1000
9	Residual Free Chlorine	0.2	1
10	Fluoride (F)	1.0	1.5
Desirable Characteristics-			
11	Dissolved Solids	500	2000
12	Calcium (Ca)	75	200
13	Magnesium (Mg)	30	100
14	Copper (Cu)	0.05	1.5
15	Manganese (Mn)	0.1	0.3
16	Sulphate (SO_4)	200	400
17	Nitrate (NO_3)	45	No relaxation
18	Phenolic Compounds	0.001	0.002
19	Mercury (Hg)	0.001	No relaxation
20	Cadmium (Cd)	0.003	No relaxation

21	Selenium (Se)	0.01	No relaxation
22	Arsenic (As)	0.01	No relaxation
23	Cyanide (CN)	0.05	No relaxation
24	Lead (Pb)	0.01	No relaxation
25	Zinc (Zn)	5.0	15
26	Hexavalent Chromium	0.05	No relaxation
27	Alkalinity	200	600
28	Aluminum (Al)	0.03	0.2
29	Boron (B)	0.5	2.4
30	Pesticides	Absent	0.001
31	Uranium	0.03	No relaxation

NTU- Nephelometric Turbidity Unit.,

Water Quality Criteria for Irrigation Purpose

Water quality plays a significant role in irrigated agriculture. Many problems originate due to inefficient management of water for agriculture use, especially when it carries high salt loads. The effect of total dissolved salts in irrigation water (measured in terms of electrical conductance) on crop growth is extremely important. Soil water passes in to the plant through the root zone due to osmotic pressure and the plants root able to assimilate water and nutrients. Thus, the dissolved solid contents of the residual water in the root zone also have to be maintained within limits by proper leaching. These effects are visible in plants by their stunted growth, low yield, discoloration and even leaf burns at margin or top. The safe limits of electrical conductivity for crops of different degrees of salt tolerances under varying soil textures and drainage conditions are presented in **Table - 5.**

Table 5: Safe Limits for electrical conductivity for irrigation water

(IS:11624-1986)

S. No.	Nature of soil	Crop Growth	Upper permissible safe limit of electrical conductivity in water µs/cm at 25°C
1	Deep black soil and alluvial soils having clay content more than 30%; soils that are fairly to moderately well Drained	Semi-tolerant	1500
		Tolerant	2000
2	Textured soils having clay contents of 20-30%; soils that are well drained internally and have good surface drainage system	Semi-tolerant	2000
		Tolerant	4000
3	Medium textured soils having clay 10-20%; internally very well drained and having good surface drainage system	Semi-tolerant	4000
		Tolerant	6000

4	Light textured soils having clay lessthan 10%; soils that have excellent internal and surface drainage system.	Semi-tolerant	6000
		Tolerant	8000

In addition to problems caused by total amount of salts, some of the specific ions like sodium, boron and trace elements, if present in water in excess, also render it unsuitable for agricultural use.

SODIUM ADSORPTION RATIO (SAR) & RESIDUAL SODIUM CARBONATE (RSC)

The clay minerals in the soil adsorb divalent cations like calcium and magnesium ions from irrigation water. Whenever the exchange sites in clay are filled by divalent cations, the soil texture is conducive for plant growth. Sodium reacts with soil to reduce its permeability. In case the irrigation water is sodium dominant, the clay lattice is filled with sodium ions due to ion exchange. Such soils become impermeable and sticky and as such the cultivation becomes difficult to support plant growth. However, the cation exchange process is reversible and can be controlled either by adjusting the composition of water or by soil amendment by application of gypsum, which releases cations (Calcium) to occupy the exchange position. The tendency of water to replace adsorbed calcium and magnesium with sodium can be expressed by the Sodium Adsorption Ratio (SAR), where all the ion concentrations are in milli-equivalents per litre (meq/L).

$$\mathbf{SAR} = \frac{\mathbf{Na}}{\sqrt{(\mathbf{Ca} + \mathbf{Mg})/2}}$$

When, water having high bicarbonates and low calcium and magnesium is used for irrigation purpose, precipitation of calcium and magnesium as carbonate takes place, changing the residual water to high sodium water with sodium bicarbonate in solution. It is termed as Residual Sodium Carbonate (RSC) which is expressed as;

$$\mathbf{RSC} = (\mathbf{HCO3} + \mathbf{CO3}) - (\mathbf{Ca} + \mathbf{Mg})$$

(Where all the ions' concentrations are in milli equivalents / litre).

Percentage sodium (%Na):

Percentage sodium (%Na) is an indication of the soluble sodium content of the groundwater and also used to evaluate Na hazard. In all natural waters, %Na is a common parameter to assess its suitability for irrigation purposes since sodium reacts with the soil to reduce permeability.

$$\%Na = \frac{(Na + K)}{(Ca + Mg + Na + K)} * 100$$

The quality of water is commonly expressed by classes of relative suitability for irrigation with reference to salinity levels. The recommended classification with respect to Electrical Conductivity, Sodium content, Sodium Adsorption Ratio, and Residual Sodium Carbonate, under customary irrigation conditions has been depicted in **Table - 6**

Table 6 : Guidelines for evaluation of quality of irrigation water

Water Class	Alkalinity hazards		
	SAR IS:11624-1986	RSC (meq/L) IS:11624-1986	%Na Wilcox
Low	< 10	< 1.5	< 20
Medium	>10 – 18	1.5 – 3	20 - 60
High	>18 – 26	3 - 6	> 60
Very High	> 26	> 6	

Effects Of Water Quality Parameters on Human Health and Distribution for Various Users

It is essential to ensure that various constituents are within prescribed limits in drinking water supplies to avoid impact on human health **(Table – 8)**. Man, life forms and domestic animals are affected by alteration in water quality due to natural or anthropogenic reasons. The effect of these substances depends on the quantity of water consumed per day and their concentration in water.

The water quality for various uses should be as per specification of water required for particular use. The chemical parameters above the permissible limit have adverse effect on human health. Hardness, measured as CaCO3, when present more than 600 mg/l may affect water supply system (Scaling), lead to excessive soap consumption, calcification of arteries. There is no conclusive proof but it may cause urinary concretions, diseases of kidney or bladder and stomach disorder. Iron in traces is essential for nutrition and high Iron concentration (> 1.0mg/l) in water, though not having major effect on human health, gives bitter sweet astringent taste, causes staining of laundry and porcelain.Nitrate at very high concentration may cause infant methaemoglobinaemia (blue babies), causes gastric cancer and affects adversely central nervous system and cardiovascular system.Fluoride less than 1.0 mg/l is desirable in drinking water as it prevents dental carries but with very high concentration may cause crippling skeletal fluorosis. Copper is essential and beneficial element in human metabolism. Deficiency results in nutritional anaemia in infants. Large amount gives astringent taste, causes liver damage, central nervous system irritation and depression. In water supply it enhances corrosion of

aluminium in particular. The desirable limit of Lead in drinking water is 0.05 mg/l. It is toxic in both acute and chronic exposures. Burning in the mouth, severe inflammation of the gastro-intestinal tract with vomiting and diarrhoea, chronic toxicity nausea, severe abdominal pain, paralysis, mental confusion, visual disturbances, anaemia etc are some of its manifestations when present in higher concentrations.The probable effects of the water quality, for drinking uses beyond the prescribed limits are summarised in the Table

Common symptoms of mercury poisoning include peripheral neuropathy (presenting as paresthesia or itching, burning or pain), skin discoloration. Other symptoms may include kidney dysfunction (e.g. Fanconi syndrome) or neuropsychiatric symptoms such as emotional lability, memory impairment, or insomnia. Long term exposure to Cyanide affects the thyroid and central nervous system adversely. In drinking water the maximum permissible limit for cyanide is 0.05 mg/l and there is no relaxation in this value as beyond this limit water becomes toxic. Arsenic is a recognized carcinogenic element. The gastrointestinal tract, nervous system, respiratory tract and skin can be severely affected. Chronic poisoning is manifested by general muscular weakness, loss of appetite and nausea, leading to inflammation of mucous membrane in the eye, nose and larynx, skin lesions may also occur. Neurological manifestations and even malignant tumours in vital organs may also be observed. Animals consuming Se rich fodder exhibit typical symptoms of Selenium poisoning. The most consistent clinical manifestations are loosing body condition and loss of hair, necrosis of tail, reluctance to move, stiff gate, and overgrowth of hooves followed by cracks gradually leading to detachment from main hoof. Water containing low amounts of uranium is usually safe to drink. Because of it's nature, uranium is not likely to accumulate in fish or vegetables and uranium that is absorbed will be eliminated quickly through urine and faeces. Uranium concentrations are often higher in phosphate-rich soil, but this does not have to be a problem, because concentrations often do not exceed normal ranges for uncontaminated soil. It is possible that intake of a large amount of uranium might damage the kidneys. There is also a chance of getting cancer from any radioactive material like uranium. Natural and depleted uranium are only weakly radioactive and are not likely to cause cancer from their radiation. The provisional guideline by WHO of Uranium for drinking water is 30 µg/l. The guideline value is designated as provisional because of outstanding uncertainties regarding the toxicology and epidemiology of Uranium.

system in general and other sensitive systems leading to immuno suppression, immuno potentiation and hypersensitivity of the host against infectious and non infectious diseases as well as causing glomerulonephritis, rheumatoid arthritis, carcinogenicity, reduced fertility, increased cholesterol, high infant mortality, varied metabolic and genetic disorders and reduced lifespan in humans and livestock populations in India. The main cause of water borne diseases and enteric diseases like cholera, typhoid, para-typhoid, bacillary, dysentery, gastro- enterititis etc. are due to the contamination of source with intestinal pathogenic micro- organisms. The contamination of drinking water by human/animal excreta faecal matter constitutes the most common mechanism for transmission of these organisms to healthy human being not only directly but also indirectly.

Impact on Plant Growth

The electrical conductivity is the measure of salt contents in the water. The effects of salinity are stunted plants growth, low yield, discoloration and even leaf burns at margin or top. High sodium in water affects the permeability of soil and causes infiltration problems. This is because sodium when present in the soil in exchangeable form replaces calcium and magnesium adsorbed on the soil clays and causes dispersion of soil particles Other problems to the crop caused by an excess of Na is the formation of crusting seed beds, temporary saturation of the surface soil, high pH and the increased potential for diseases, weeds, soil erosion, lack of oxygen and inadequate nutrient availability. Bicarbonate hazard, expressed as RSC, when above 2.5 meq/l results in increase of sodium causing adverse effect. When water having high bicarbonates and low calcium and magnesium is used for irrigation purpose, precipitation of calcium and magnesium as carbonate takes place, changing the residual water to high sodium water with sodium bicarbonate in solution. Boron is an essential plant nutrient but concentration above 4.0 mg/l is toxic to plant.Copper, Lead and Zinc are essential plant nutrients but very high concentration may be toxic and reduce root growth. Chromium above 1.0 mg/l is toxic to plants. Very high concentration may reduce growth, produce iron deficiency in plants and reduce the yields. High concentration of Cadmium (>0.5 mg/ l) reduces plant growth, bio-accumulates in plants and reduces yields. Iron is an important and essential element. Deficiency caused by excess of lime in soils, results in chlorosis. Excess iron contributes to soil acidification. Excess of Nickel in irrigation water causes stunted growth of plants when concentration is above 0.5 mg/l. It is toxic to barley, beans, Oats, when more than 2.0 mg/l.

Impact on Industries

The quality requirements for industrial water supplies range widely and almost every industrial application has it's own standards. Low pH increases corrosion of concrete; pH 7 is required for most industries, pH 6.7-7.2 is advised for carbonated beverage industry. Total dissolved solids above 3000 mg/l cause foaming in boilers and solids interfere with cleanliness, colour or taste of finished products. Low TDS values are required in most industries, high TDS leads to corrosion. Recommended value of Iron for food processing units is 0.2mg/l, for paper and photographic industry iron of 0.1 mg/l is recommended, iron less than 0.1 mg/l is recommended in cooling waters. Fluoride above 1.0 mg/l is harmful in industries involved in production of food, beverages, pharmaceuticals and medical items while nitrate above 30 mg/l is injurious to dyeing of wool and silk fabrics and harmful in fermentation process for brewing. Nitrate in some water protects metals in boilers from inter-crystalline cracking. Copper is undesirable in food industry as it has colour reactions and imparts fishy taste to finished products. Affects smoothness and brightness of metal deposits in metal plating, baths. No guidelines have been given for Chromium, Zinc and Lead for water to be used for industrial purposes.The water quality standards are laid down to evaluate suitability of water for intended uses and to safeguard water from degradation. These recommended limits form the basis of treatment needed for improvement in quality of water before use. In the formulation of water quality standards, the selection of parameters is considered depending upon its end use.

WATER POLLUTION & ITS ENVIRONS

The quality of groundwater may be impacted by naturally occurring processes as well as by the activities directly attributable to human interventions in different environs. The complex biodiversity, physiographic setup coupled with prevailing hydrogeological set up attribute to water pollution in various parts of the State. The magnitude of environmental impact associated with each of these processes is highly complicated and variable. Four general ways in which the chemical composition of water may be changed include natural processes, agricultural and urban runoff industrial effluents, waste disposal practices, and spills, leaks and other unintentional / intentional releases. In the natural way of contamination, the leaching of natural chemical deposits can also result in increased concentration of chlorides, sulfates, fluorides, Arsenic, nitrates, iron, and other inorganic chemicals.

Table: 7- Sources of Ground water Contamination

Category - I	**Category - II**	**Category - III**
Sources designed to discharge substances	Sources designed to store, treat, and /or dispose of substances: discharge through unplanned releases	Sources designed to retain substances during transport or transmission
Subsurface percolation (eg. Septic tanks, etc), injection wells, land applications	Landfills, open dumps, surface impoundments, waste tailings/piles, above ground/underground storage tanks, radioactive disposal sites	Pipelines, material transport and transfer
Category - IV	**Category - V**	**Category - VI**
Sources discharging as consequence of other planned activities	Sources providing conduit or inducing discharge through flow patterns	Natural occurring sources whose discharge is created and /or exacerbated by human activity
Irrigation practices, Pesticide applications, Fertilizers use, animal feedings, urban runoff, percolation of atmospheric pollutants, mining and mine drainage	Production wells, Other wells, Construction excavation	Groundwater-surface water interactions, natural leaching, salt water intrusion, upconing

Environmental pollution is an undesirable change in the physical, chemical and biological characteristics of the environment. Such changes are caused by substances that are introduced into the environment, by human interferences and natural causes also. Broadly, two types of pollution exist and these are as follows:

Geogenic

Deterioration of quality of ground water due to natural contamination from aquifers and overlaying soils is called geogenic contamination. This type of contamination occurs due to entrapped water reaction with the strata. Presence of high Fluoride, Selenium and Arsenic are usually a result of geogenic contamination as there are only a very few other source of these ions.

8.6.5- Anthropogenic

Agriculture Activities: Fertilizers are an important input in the agriculture production. Initially organic fertilizers were mainly used in fields, however, later on use of chemical fertilizers have played a very important role in enhancing the agricultural production in the state.

Use of fertilizers: Nitrogenous based fertilizer releases large amounts of NO_3^-which accumulate in the soil profile and is susceptible to leaching.

Animal wastes Disposal: unscientific disposal of Animal wastes, dung and urine around dairy sheds appear to be the major contributors to high NO_3^--N in groundwater under village inhabitations and feedlots.

Use of Pesticides: Due to rampant use of pesticides for agricultural activity there have been numerous reports of pesticides residues in food and water.

Industrial Waste water Pollution: Organic and toxic wastes from industries cause water pollution

Municipal Waste: Application of sewage sludge to agricultural fields and untreated industrial effluents alone, or in combination with ground/canal water, especially in the vicinity of large cities, as these are considered reusable sources of essential plant nutrients and organic Carbon are causing pollution to the ground water. Discharge of partially/untreated water contributes to biological contamination of surface and groundwater.

Effects of water quality parameters on human health when used fordrinking Purpose

S. No.	Parameters	Prescribed limits IS:10500, 2012		Probable Effects
		Desirable Limit	Permissible Limit	
1	Colour (Hazen unit)	5	15	Makes water aesthetically undesirable
2	Odour	Essentially free from objectionable odour		Makes water aesthetically undesirable
3	Taste	Agreeable		Makes water aesthetically undesirable
4	Turbidity (NTU)	1	5	High turbidity indicates contamination / Pollution.
5	pH	6.5	8.5	Indicative of acidic or alkalinewaters, affects taste, corrosivity and the water supply system
6	Hardness as $CaCO_3$ (mg/L)	200	600	Affects water supply system (Scaling), Excessive soap consumption, and calcification of arteries. There is no conclusive proof but it may cause urinary concretions, diseases of kidney or bladder and stomach disorder.
7	Iron (mg/L)	1.0	No relaxation	Gives bitter sweet astringenttaste, causes staining of laundry and porcelain. In traces it isessential for nutrition.
8	Chloride (mg/L)	250	1000	May be injurious to some people suffering from diseases of heart or kidneys. Taste, indigestion, corrosion and palatability are affected.
	Residual Chlorine (mg/L) Only when water is Chlorinated	0.20	-	Excessive chlorination of drinking water may cause asthma,colitis and eczema.
10	Total Dissolved Solids-TDS (mg/L)	500	2000	Palatability decreases and may cause gastro intestinal irritation in human, may have laxative effect particularly upon transits and corrosion, may damage water system.
11	Calcium (Ca) (mg/L)	75	200	Causes encrustation in water supply system. While in sufficiency causes a severe type of rickets, excess causes concretions in the body such as kidney or bladder stones and irritation in urinary passages.

S. No.	Parameters	Prescribed limits IS:10500, 2012		Probable Effects
		Desirable Limit	Permissible Limit	
12	Magnesium (mg) (mg/L)	30	100	Its salts are cathartics and diuretic. High concentration may have laxative effect particularly on new users. Magnesium deficiency is associated with structural and functional changes. It is essential as an activator of many enzyme systems.
13	Copper (Cu) (mg/L)	0.5	1.50	Astringent taste but essential and beneficial element in human metabolism. Deficiency results in nutritional anemia in infants. Large amount may result in liver damage, cause central nervous system irritation and depression. In water supply it enhance corrosion of aluminum in particular
14	Sulphate (SO_4) (mg/L)	200	400	Causes gastro intestinal irritation along with Mg or Na, can have a cathartic effect on users, concentration more than 750 mg/L may have laxative effect along with Magnesium.
15	Nitrate (NO_3) (mg/L)	45	No relaxation	Cause infant methaemoglobinaemia (blue babies) at very high concentration, causes gastriccancer and affects adversely central nervous system and cardiovascular system.
16	Fluoride (F) (mg/L)	1.0	1.50	Reduce dental carries, very high concentration may cause crippling skeletal fluorosis.
17	Cadmium (Cd) (mg/L)	0.003	No relaxation	Acute toxicity may be associated with renal, arterial hypertension, itai-itai disease, (a bone disease).Cadmium salt causes cramps, nausea, vomiting and diarrhea.
18	Lead (Pb) (mg/L)	0.01	No relaxation	Toxic in both acute and chronic exposures. Burning in the mouth, severe inflammation of the gastro-intestinal tract with vomiting and diarrhoea, chronic toxicity produces nausea, severe abdominal pain, paralysis, mentalconfusion, visual disturbances, anaemia etc.
19	Zinc (Zn) (mg/L)	5	15	An essential and beneficial element in human metabolism. Taste threshold for Zn occurs at about 5 mg/L imparts astringent taste to water.

S. No.	Parameters	Prescribed limits IS:10500, 2012		Probable Effects
		Desirable Limit	Permissible Limit	
20	Chromium (Cr^6) (mg/L)	0.05	No relaxation	Hexavalent state of Chromium produces lung tumors can produce cutaneous and nasal mucous membrane ulcers and dermatitis.
21	Boron (B) (mg/L)	0.5	2.4	Affects central nervous system itssalt may cause nausea, cramps, convulsions, coma etc.
22	Alkalinity (mg/L) as $CaCO_3$	200	600	Impart distinctly unpleasant taste may be deleterious to human being in presence of high pH, hardness and total dissolved solids.
23	Pesticides: (m g/l)	Absent	0.001	Imparts toxicity and accumulated in different organs of human body affecting immune and nervous systems may be carcinogenic.
24	Phosphate (PO_4) (mg/L)	No guideline		High concentration may causevomiting and diarrhea, stimulate secondary hyperthyroidism andbone loss
25	Sodium (Na) (mg/L)	No guidelines		Harmful to persons suffering From cardiac, renal andcirculatory diseases.
26	Potassium (K) (mg/L)	No guidelines		An essential nutritional elementbut its excessive amounts is cathartic
27	Silica (SiO_2) (mg/L)	No guidelines		-
28	Nickel (Ni) (mg/L)	0.02		Non-toxic element but may becarcinogenic in animals, can react with DNA resulting in DNAdamage in animals.
29	Pathogens (a) Total coliform (per100ml) (b) Faecal Coliform (per 100ml)	nil		Cause water borne diseases like coliform Jaundice, Typhoid, Cholera etc. produce infections involving skin mucous membrane of eyes, ears and throat.
30	Arsenic	0.01	**No relaxation**	Various skin diseases, Carcinogenic
31	Uranium	0.03	**No relaxation**	Kidney disease, Carcinogenic

GROUND WATER QUALITY MONITORING

The International Standard Organization (ISO) has defined monitoring as," The programmed process of samplings, measurements and subsequent recording or signaling or both, of various water characteristics, often with the aim of assessing, conformity to specified objectives". A systematic plan for conducting water quality monitoring is called Monitoring Programme, which includes monitoring network design, preliminary survey, resource estimation, sampling, analysis, data management & reporting.

Monitoring of ground water quality is an effort to obtain information on chemical quality through representative sampling in different hydrogeological units. Ground Water is commonly tapped from phreatic aquifers through dugwells in a major part of the country and through springs and HPs in hilly areas. The main objective of ground water quality monitoring programme is to get information on the distribution of water quality on a regional scale as well as lattice is to create a background data bank of different chemical constituents in ground water.

One of the main objectives of the ground water quality monitoring is to assess the suitability of ground water for drinking purpose. The quality of drinking water is a powerful environmental determinant of the health of a community. The problem of the quality of water resources in general, and groundwater resources in particular, is becoming increasingly important in both industrialized and developing nation. In developing countries like India, the essential concerns as regards water resources are their quantity, availability, sustainability and suitability. Groundwater plays a leading role because it has of fundamental importance to all living beings.

Even though water is the most frequently occurring substance on earth, lack of safe drinking water is more prominent in the developing countries. Due to increasing world population, extraction of groundwater is also increasing for irrigations, industries, municipalities and urban and rural households' day by day. During dry season extensive withdrawal of groundwater for irrigation purpose is lowering the water table in the aquifer and also changing the chemical composition of water.

The physical and chemical quality of ground water is important in deciding its suitability for drinking purposes. Bureau of Indian Standards (BIS) formally known as Indian Standard Institute (ISI) vide its document IS: 10500:2012, Edition 3.2 (2012-15) has recommended the quality standards for drinking water. On this basis of classification, the natural ground water of India has been categorized as desirable, permissible and unfit for human consumption.

From the analytical results, it is seen that majority of water samples collected from observation / monitoring wells of CGWB in a major part of the country fall under desirable or permissible category and hence are suitable for drinking purposes. However, a small percentage of well waters are found to have concentrations of some constituents beyond the permissible limits. Such waters are not fit for human consumption and are likely to be harmful to health on continuous use.

Data Validation / Data Quality Control

Groundwater quality data validation is an essential step in ensuring the reliability and accuracy of the data. Here are some of the main steps for groundwater quality data validation.

a. Checking of Data Consistency: Checking of the data for consistency by comparing the measurements of a particular parameter over time. This will help identify any changes in the groundwater quality due to measurement methodology or equipment
b. Checking the correlation between EC and TDS:
    a. The relationship between the two parameters is often described by a constant (commonly between 0.55 and 0.95 for freshwaters).
    b. Thus: TDS (mg/l) ~ (0.55 to 0.95) x EC (mS/cm).
    c. The value of the constant varies according to the chemical composition of the water. For freshwaters, the normal range of TDS can be calculated from the following relationship:
    d. 0.55 conductivity (mS/cm) < TDS (mg/l) < 0.95 conductivity (mS/cm).
    e. Typically the constant is high for chloride rich waters and low for sulphate rich waters.

c. Checking the cation-anion balance

When a water quality sample has been analysed for the major ionic species, one of the most important validation tests can be conducted: the cation-anion balance.

Sum of cations = sum of anions

where:

cations = positively charged species in solution (meq/l) anions = negatively charged species in solution (meq/l)

The Electronic charge balance is expressed as follows:

$$\text{Electronic Charge Balance (ECB \%)} = \frac{[\sum \text{cations} - \sum \text{anions}]}{[\sum \text{cations} + \sum \text{anions}]} \times 100$$

All concentrations should be in epm. Error charge balance has been computed for the chemical results of 2022-23 and analysis showing more than 10% ECB has not been accepted as it indicates that there has been an error made in at least one of the major cation/anion analyses.

8.6.7 Sampling & Analysis :

For the evaluation of Hydro-Chemical status and distribution of various chemical constituents

in Ground water of Rajasthan state, 630 (Including Hot Spots) water samples were collected from NHS during pre-monsoon, 2023 from open dug wells and HPs, which are fully or partially in use. and analyzed in Regional chemical laboratory(a NABL accreditated lab). Sampling points are mostly open dug wells and HPs, which are fully or at least are partially in use. Chemical analysis was carried out for major cations (Ca, Mg, Na, K) and anions (CO_3, HCO_3, Cl, SO_4, NO_3, F) in addition to pH, EC, PO_4, TH as $CaCO_3$, in the Chemical Laboratory at Jaipur. Standard analytical procedures as given in APHA 2012 were followed. For the beneficial use of water its purity is essential otherwise it may affect human health adversely. The quality of water depends on its physical and chemical properties. Physical properties include colour, odour & turbidity which can be determined by our senses. The chemical properties depend on the nature & quantity of various chemical constituents individually or jointly. The possible sources, effect on human health & distribution of some major Chemical constituents are described in following chapter. Results of chemical analysis of water samples are placed in Annexure I.

The standard analytical methods followed for determination of various parameters are given in Table 9.

Table 9, Standard Analytical Methods

Parameters	Analytical Methods
pH	Electro-metric method, pH meter
Conductivity (EC)	Electrical conductivity method, EC meter
Carbonate & bicarbonate (CO_3, HCO_3)	Titrimetric method
Chloride (Cl)	Argentometric method
Sulphate (SO_4)	Turbidimetric Method
Nitrate (NO_3)	Ultraviolet spectrophotometric method
Fluoride (F)	ECR method
Phosphate (PO_4)	Stannous Chloride Method
Total hardness (T.H)	EDTA-Titrimetric method
Calcium (Ca)	EDTA-Titrimetric method
Magnesium (Mg)	By difference
Sodium (Na)	Flame photometric method
Potassium (K)	Flame photometric method
Iron	Phenanthroline method
Total dissolved solids (TDS)	By Calculation
Heavy Metals	AAS Method
Uranium	Fluorimeter

Hydrochemistry :

Electrical Conductance (EC)

Electrical Conductance is the ability of a substance to conduct an electric current. Chemically pure water in liquid form has a very low conductance. The presence of dissociated ions in

solution renders the solution conductive. Distribution of Electrical Conductance in 2023 is presented in Plate- 8

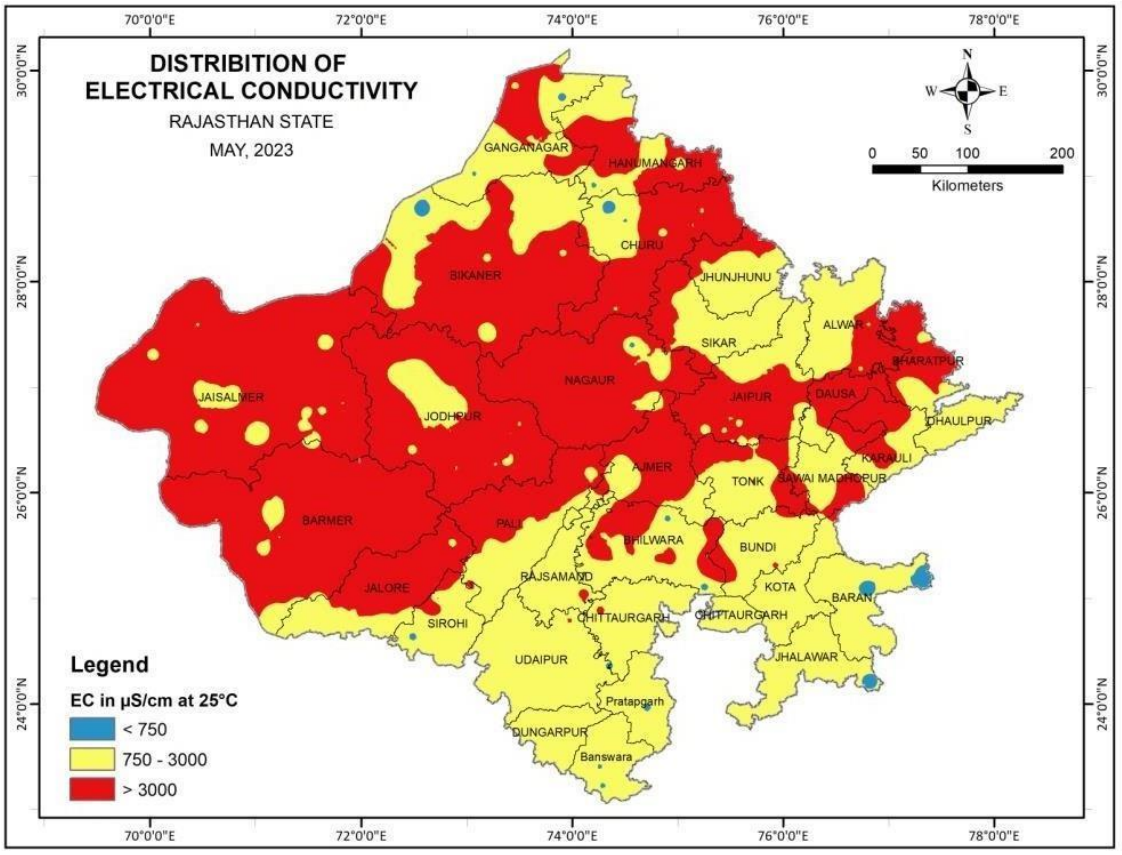


Plate-VIII :- Distribution of Electrical Conductance –May 2023

EC of a solution, therefore, gives an idea about the quantity of ions or dissolved solids present in it. In western, central and some eastern parts of the state higher EC values of water (>3000 µS/cm) have been observed thus making the ground water saline and non-potable. In southern and some eastern part of the state water is fresh as the EC values are within 1500 µS/cm.

Electrical conductivity or Total dissolved solids or Salinity is the dissolved salt content in a water body. Different substances dissolve in water giving it taste and odor. Electrical conductivity represents total

number of cations and anions present in groundwater, indicating ionic mobility of different ions, total dissolved solids and saline nature of water

In general water having EC < 1500 µS/cm, is considered as fresh water, EC 1500–15000 µS/cm, is considered as brackish water and >15000µS/cm is considered as saline water. Salinity always exists in ground water but in variable amounts. It is mostly influenced by aquifer material, solubility of minerals, duration of contact and factors such as the permeability of soil, drainage facilities, quantity of rainfall and above all, the climate of the area. BIS has recommended a drinking water standard for total dissolved solids a limit of 500mg/I corresponding to EC of about 3000 US/cm at 25°C) that can be extended to a TDS of 2000mg/I (corresponding to EC of about 3000 US/cm at 25°C) in case of no alternate source. Water having TDS more than 2000 mg/litre are not suitable for drinking purposes.

Distribution of Electrical Conductivity (EC)

The EC value of ground waters in the State varies from 136 at Rajpura, Churu Block,of Churu District , to 27200 µS/cm at Taranagar , Taranagar block of Churu at 25°C. Grouping water samples based on EC values, it is found that 7.14 % of them have EC less than 750 µS/cm.44.13 % have between 750 and 3000 µS/cm and the remaining 48.73 % of the samples have EC above 3000µS/cm. The map showing aerial distribution of EC (Plate 8) with intervals corresponding to limits as above indicates that less than 750 class of water occur throughout the state in few patches but in high proportion is in northern western parts of the State. The ground water occurring with in permissible limit 2000 mg/l of TDS in the southern and some part in north east and most of part in south west comprising of parts of Banswara,Baran, Daulpur, Dungerpur Jhalawar, Kota and Pratapgarh district. The ground water occurring beyond permissible limit 2000 mg/l of TDS in Barmer (81.48%),Nagaur (74.36%),Jodhpur (69.44%),Jaislmer(63.64 %),Churu (61.36%),Bhartatpur (61.11%),Dausa (60.00%),Jalore (56.62 %),Karauli (54.55%),Jaipur (53.13%),Jhunjhunu (52.63%), Hnaumangarh and Tonk (50% each), Pali947.37%), Bhilwara (44.44%),Ajmer (42.86%) & Bikaner(40.54%) given in annexure-III . Data is reveals that most of west Rajasthan and north west is having very poor water quality for drinking purposes. In 2023 analysis is carried out and found 48.73 % samples having TDS values is beyond permissible limit. Periodic variation is given below in table 10A and 10B quality continue detoriated from 2020 to 2023. District wise Range and Percentage value of distribution of EC in shallow GW of Rajasthan. Given in table 10C. Periodic variation of EC in ground water during the period from 2020 TO 2023 is increasing trend given below. More change is show in data from 2022 to 2023 due to revise WQ policy-2023. Most Possible reasons for deteriotion are Agricultural activities: Pesticides, fertilizers, and insecticides used in agriculture can mix into water and affect its quality and geogenic source and less rainfall recharge in ground water, over exploitation of ground water is also reason for

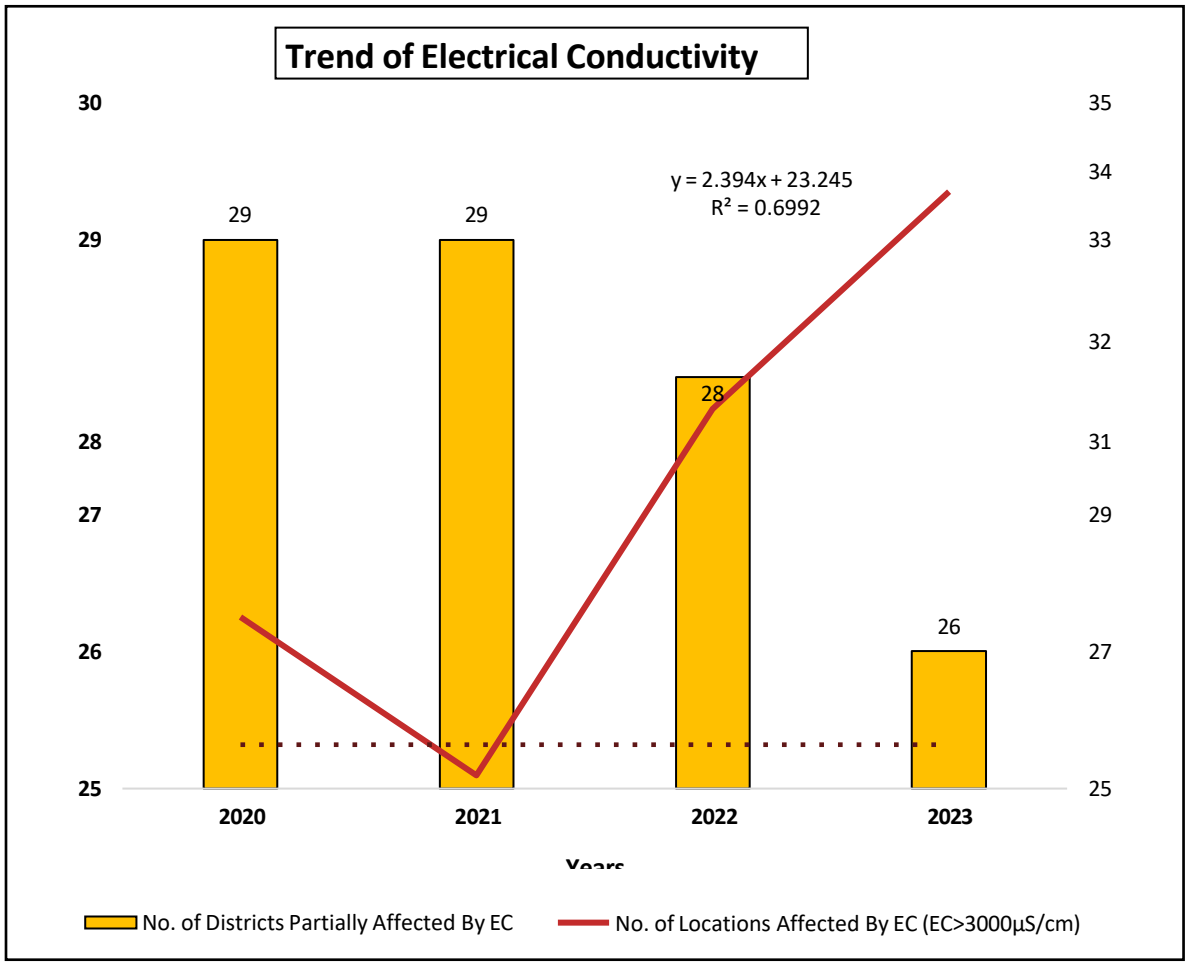
high EC in ground water.Industrial waste: waste materials from industries, such as liquids and solids, are dumped into water bodies.

Table- 10A : Periodic Variation in Different ranges of EC Since 2020 to 2023

Parameter	**Class**	**Pecrntage of samples**				**Periodic variation**
		2020	2021	2022	2023	PERIODIC Variation 2020-2023
		n=(640)	n=(774)	n=(809)	n=(630)	
Salinity as EC	<750 us/cm	19.90	18.23	11.07	7.14	11.75
	750-3000	52.6	56.58	58.40	44.13	8.47
	>3000	27.5	25.19	30.53	48.73	-20.23

Table -10B : Percent of locctions and Number of districts affected since 2020-2023

year	**No. of districts**	% of locations affected by EC
2020	**29**	**27.5**
2021	**29**	**25.19**
2022	**28**	**30.53**
2023	**26**	**48.73**



Trend of EC in Rajasthan

10C : District wise Range and Percentage value of distribution of EC in shallow GW of Rajasthan

	district	No.of samples analysed	Permissible limit (µS/cm)	Min	Max.	Mean	Number of samples (Percent)		
							<750	750-3000	>3000
1	AJMER	14	3000	575	9740	3256	7.14	50.00	42.86
2	ALWAR	15	3000	710	8300	2408	6.67	80.00	13.33
3	BANSWARA	14	3000	440	1770	1059	14.29	85.71	0.00
4	BARAN	5	3000	530	1390	990	40.00	60.00	0.00
5	BARMER	54	3000	594	21760	6458	1.85	16.67	81.48
6	BHARATPUR	18	3000	720	9420	4074	5.56	33.33	61.11
7	BHILWARA	27	3000	390	9380	3201	14.81	40.74	44.44
8	BIKANER	37	3000	358	14100	3689	10.81	48.65	40.54
9	BUNDI	9	3000	820	3220	1836	0.00	88.89	11.11
10	CHITTAURGARH	5	3000	590	3300	1542	20.00	60.00	20.00
11	CHURU	44	3000	136	27200	6270	11.36	27.27	61.36
12	DAUSA	10	3000	469	10410	4010	10.00	30.00	60.00
13	DHAULPUR	6	3000	790	2530	1307	0.00	100.00	0.00
14	DUNGARPUR	4	3000	926	1610	1177	0.00	100.00	0.00
15	GANGANAGAR	11	3000	426	8450	2570	18.18	54.55	27.27
16	HANUMANGARH	16	3000	316	6990	3008	12.50	37.50	50.00
17	JAIPUR	32	3000	760	14700	3690	0.00	46.88	53.13
18	JAISALMER	33	3000	760	12350	4274	0.00	36.36	63.64
19	JALORE	23	3000	680	18400	4096	8.70	34.78	56.52
20	JHALAWAR	12	3000	440	1780	1195	8.33	91.67	0.00
21	JHUNJHUNU	19	3000	582	7560	3208	10.53	36.84	52.63
22	JODHPUR	72	3000	250	25000	6112	4.17	26.39	69.44
23	KARAULI	11	3000	1200	7000	3322	0.00	45.45	54.55
24	KOTA	1	3000	1920	1920	1920	0.00	100.00	0.00
25	NAGAUR	39	3000	370	20250	5796	2.56	23.08	74.36
26	PALI	19	3000	668	19180	4418	5.26	47.37	47.37
27	PRATAPGARH	7	3000	540	2190	1317	14.29	85.71	0.00
28	RAJSAMAND	15	3000	740	3440	1942	6.67	80.00	13.33
29	S.MADHOPUR	11	3000	570	8300	3052	9.09	63.64	27.27
30	SIKAR	8	3000	916	3150	1882	0.00	87.50	12.50
31	SIROHI	13	3000	375	5690	1865	30.77	53.85	15.38
32	TONK	14	3000	750	14400	3574	7.14	42.86	50.00
33	UDAIPUR	12	3000	880	3130	1680	0.00	91.67	8.33
		630	3000	136	27200	3036	7.14	44.13	48.73

S.No.	District	No. of locations having EC>3000 µS/cm			
		2020	2021	2022	2023
1	AJMER	7	9	3	6
2	ALWAR	1	1	3	2
3	BANSWARA	0	0	1	0
4	BARAN	3	0	0	0
5	BARMER	28	18	28	44
6	BHARATPUR	9	8	11	11
7	BHILWARA	4	16	10	12
8	BIKANER	5	8	13	15
9	BUNDI	4	3	3	1
10	CHITTAURGARH	3	1	1	1
11	CHURU	8	9	21	27
12	DAUSA	3	5	6	6
13	DHAULPUR	0	2	4	0
14	DUNGARPUR	1	0	0	0
15	GANGANAGAR	1	8	4	3
16	HANUMANGARH	3	10	8	8
17	JAIPUR	18	11	16	17
18	JAISALMER	17	15	19	21
19	JALORE	4	4	12	13
20	JHALAWAR	3	4	0	0
21	JHUNJHUNU	0	1	4	10
22	JODHPUR	14	17	35	50
23	KARAULI	3	3	5	6
24	KOTA	1	0	0	0
25	NAGAUR	12	7	14	29
26	PALI	6	6	7	9
27	PRATAPGARH	0	1	0	0
28	RAJSAMAND	4	3	5	2
29	SAWAI MADHOPUR	3	4	4	3
30	SIKAR	1	10	2	1
31	SIROHI	2	3	3	2
32	TONK	7	6	2	7
33	UDAIPUR	1	2	3	1
		176	195	247	307

Chloride (Cl)-

It is one of the most common constituent present in natural water and remains soluble in water unaffected by biological processes therefore reducible by dilution. Natural mineral origin can also be a cause of high chloride content. Industrial effluents (galvanizing plants, water softening plants, oil wells, refineries and paper works) may also leach into ground water. Distribution of Chloride May 2023is given below in plate 9.

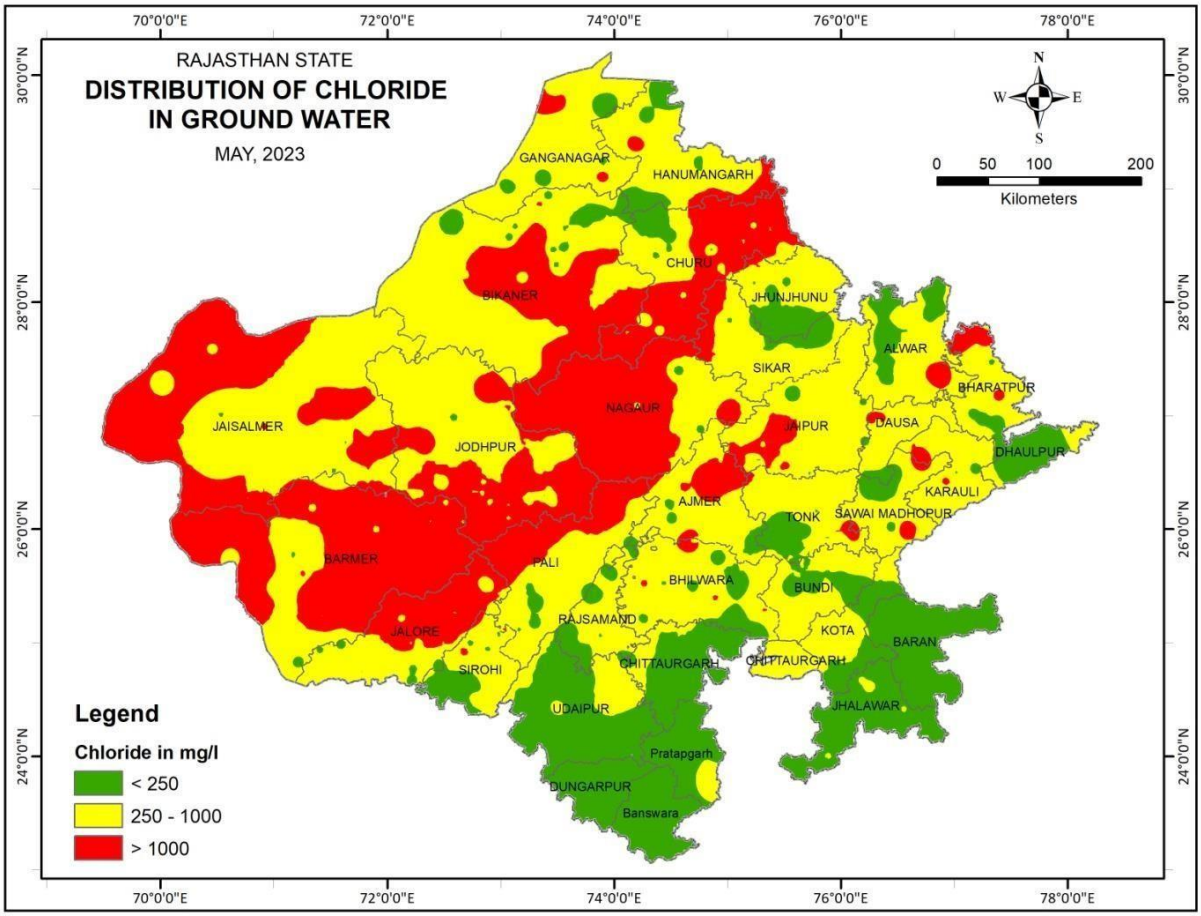


Plate-9:- Distribution of Chloride May 2023

Sewage effluents contain a larger concentration of Chlorides. Chloride ions have some functions in the body. The tolerance limits of chloride vary with climate and excretion. Cation associated with chloride is usually has harmful effects on human body. Individual affected by heart and kidney disease should restrict water consumption with a high chloride concentration. In western, central and some eastern parts of the state high Chloride (Cl) values (>1000 mg/l) have been observed thus making the ground water bitter in taste and non-potable.Out of 630 sample analysed, 26.51 % have chloride value beyond permissible limit of 1000 mg/l. 40.16 % between acceptable and permissible limit and 33.33 % samples are within acceptable limit. In Nagaur (53.85 %) district, Barmer(51.85%) , Jodhpur (47.22 %), Jaisalmer (39.40%), Jalore (39.13%), & Churu (31.82 %), chloride value is beyond permissible limit.In Banswara, Bundi, Baran, Chittaurgarh Dholpur, Dungarpur,Jhalawar, Kota, Rajsamand Pratapgarh , Sikar,& Udaipur districts, none of the sample shows chloride value beyond permissible limit. Minimum value 7 mg/l is observed at at Rajpura, Churu Block,of Churu District and Maximum value of chloride (12500 mg/l) Chicharli, Luni Block,

District Jodhpur. Periodic variation 2020 to 2023 is given below in table 11A and 11B , quality continue detoriated from 2020 to 2023. Periodic variation of Cl in ground water

Table- 11A : Periodic variation in chloride since 2020 to 2023

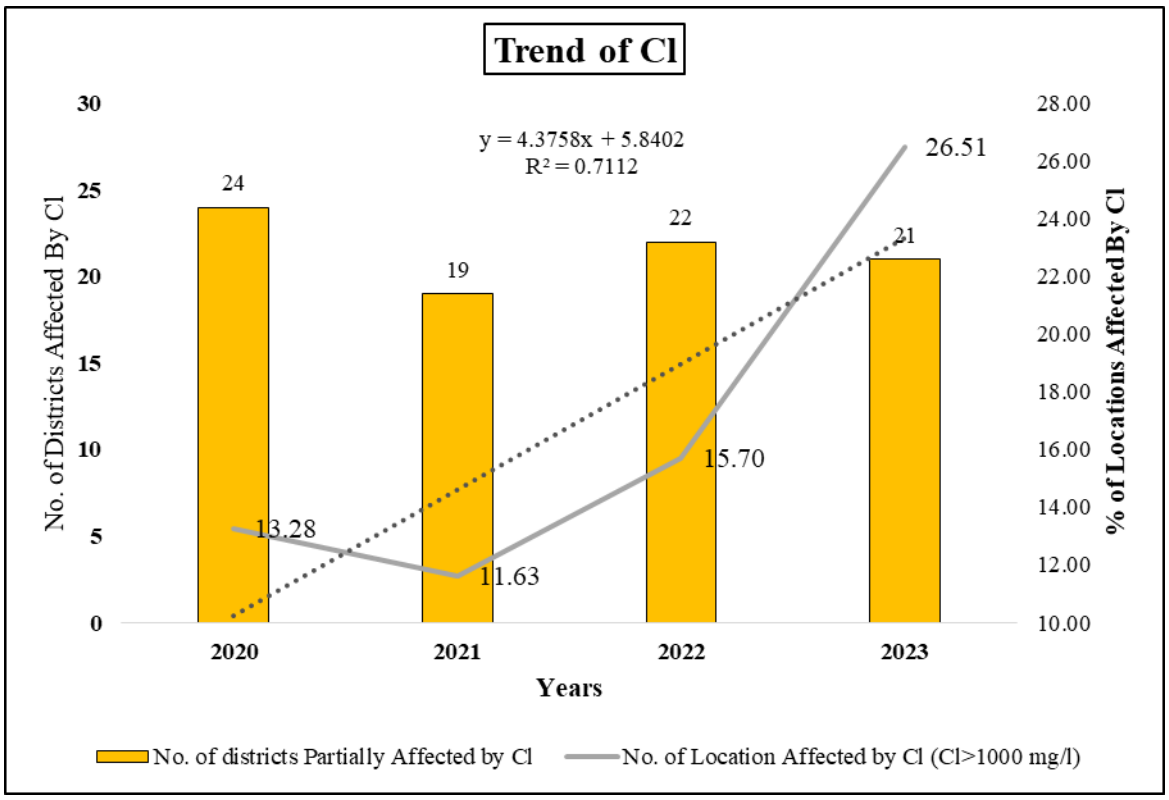
Parameter	Class (mg/l)	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		N=640	N=774	N=809	N=630	
Chloride	<250	57.34	56.20	50.93	33.33	24.01375
	250-1000	29.375	32.17	33.37	40.16	-10.785
	>1000	13.28	11.62	15.7	26.51	-13.22875

during the period from 2020 TO 2023 is increasing trend given below in plate No.-9B .

More change is show in data from 2022 to 2023 due to revise WQ policy-2023. Most Possible reasons for deteriotion are Agricultural activities: Pesticides, fertilizers, and insecticides used in agriculture can mix into water and affect its quality and geogenic source and less rainfall recharge in ground water, over exploitation of ground water is also reason for high Cl in ground water.Industrial waste: waste materials from industries, such as liquids and solids, are dumped into water bodies.

Table -11B : Percent of locctions and Number of districts EC affected since 2020-2023

year	No. of districts Partially Affected by Cl	No. of Location Affected by Cl (Cl>1000 mg/l)
2020	24	13.28
2021	19	11.62
2022	22	15.70
2023	21	26.51



Trend of chloride since 2020 to 2023

Sulphate (SO_4)-

Sulphates are found in natural water in the final oxidized state of sulphides, sulphites and thiosulphates or in the oxidized stage of organic matter in the sulphur cycle; in all cases as a product of pollution sources related to mining or industrial waste. Detergents add Sulphate to sewage. Tanneries, steel mills, textile plants may contaminate water. Sulphate ions associated with high concentration of Magnesium and sodium ions, acts as laxative and may cause gastric disorders. In all, 47.14 % samples fall within acceptable limit, 24.13 % within acceptable and permissible limit and 28.7 % samples are beyond permissible limit of BIS guidelines for drinking water. In Barmer (59.26 %),Nagaur (56.41%), Dausa (40%), Hanumangarh(37.50%), Pali (36.84%) and Jodhpur 34.72% districts water samples have Sulphate value beyond permissible limit (400 mg/l). Minimum value of sulphate (1 mg/l) at Mahuda in Chittaurgarhr district and maximum value of sulphate (4080 mg/l) has been observed at Photaniyon ki Dhani, Bisalo ki Basti, in Barmer district.

Nitrate (NO_3)

Sources of Nitrate are mineral deposits (sodium and potassium nitrates), soils, sea water and atmosphere. Nitrate is used as a fertilizer, as a food preservative and as an oxidizing agent in the chemical industries. Higher concentrations are expected where fertilizers are used, in decayed animals and vegetable matter, in leachates from sludge and refuge disposal and in industrial discharges. Higher concentration of nitrate causes Methemoglobinemia disease in bottle fed infants (3 months old). In western, north western, southern and some eastern parts of the state high nitrate values (>45mg/l) have been observed thus making the ground water non potable. Gastrointestinal disorders are also founds. It may also have adverse effect on central nervous and cardio vascular system.Naturally occurring nitrate forms when nitrogen and oxygen combine in soil, primarily sourced from atmospheric nitrogen. Groundwater nitrate mainly comes from chemical fertilizers, animal manure leaching, and sewage discharge. Identifying natural vs. man- made sources is challenging. Chemical and microbiological processes like nitrification and denitrification also affect groundwater nitrate levels.As per the BIS standard for drinking water the maximum desirable limit of nitrate concentration in groundwater is 45 mg/l. Though nitrate is considered relatively non-toxic, a high nitrate concentration in drinking water is an environmental health concern arising from increased risks of methaemoglobonaemia particularly to infants. Adults can tolerate little higher concentration.

Distribution of Nitrate (NO3) in analysis of 2023 –

The probable sources of nitrate contamination of ground water are through excessive application of fertilizers, bacterial nitrification of organic nitrogen, and seepage from animal and human wastes and atmospheric inputs. In the State, nitrate in ground water samples varies from 0.0 to 1180 mg/L.BIS permits a maximum concentration of 45 mg/L nitrate in drinking water. Considering this limit, it is found that 50.32 % of the samples, spread over the entire State, have nitrate below.

49.68 % samples having beyond the permissible limit . Maximum value of nitrate 1180 mg/l has been observed at Shawa in Churu district. Pratapgarh district 85.71 % , Barmer 66.67% Churu and Karauli 63.64 % each , Baran and chittaurgarh 60.0 % each , Banswara and Tonk 57.14 % each , Jodhpur 56.94% , Hanumangarh and Jaipur 56.25% each , Sikar and Udaipur 50% each Nagaur 48.72%, Bhilawara 48.15%, Jalore 47.83% Pali 47.37% Ganganagar and Sawaimadhopur 45.45% each , Ajmer 42.86% and Alwar 40% having more than permissible limit nitrate value . Trend of nitrate is given below in plate 9C, Periodic variation in suitability Classes of Nitrate in groundwater of Rajasthan given in below table and distribution of nitrate in the state is given in below map. High nitrate concentrations grow due to human activities, such as agriculture, industry, domestic effluents and emissions from combustion engines.It has been observed that lack/less severage sestem like Jaipur city(in old city) a reason where nitrate is reported high .It may be reduced by proper sewagege/drainage system may be developed in effected arreas. Trend of Nitrate and distribution of nitrate in Rajasthan based on NHS 2023 is given below in plate -9C and 10 respectively. Periodic variation in suitability Classes of nitrate in groundwater of Percent of locctions and number of districts nitrate affected since 2020-2023 are given below in table Rajasthan is gien below in table -12 and 12A. District wise percent range and distribution of nitrate in shallow GW of Rajasthan given below in table 12B. More change is show in data from 2022 to 2023 due to revise WQ policy-2023.

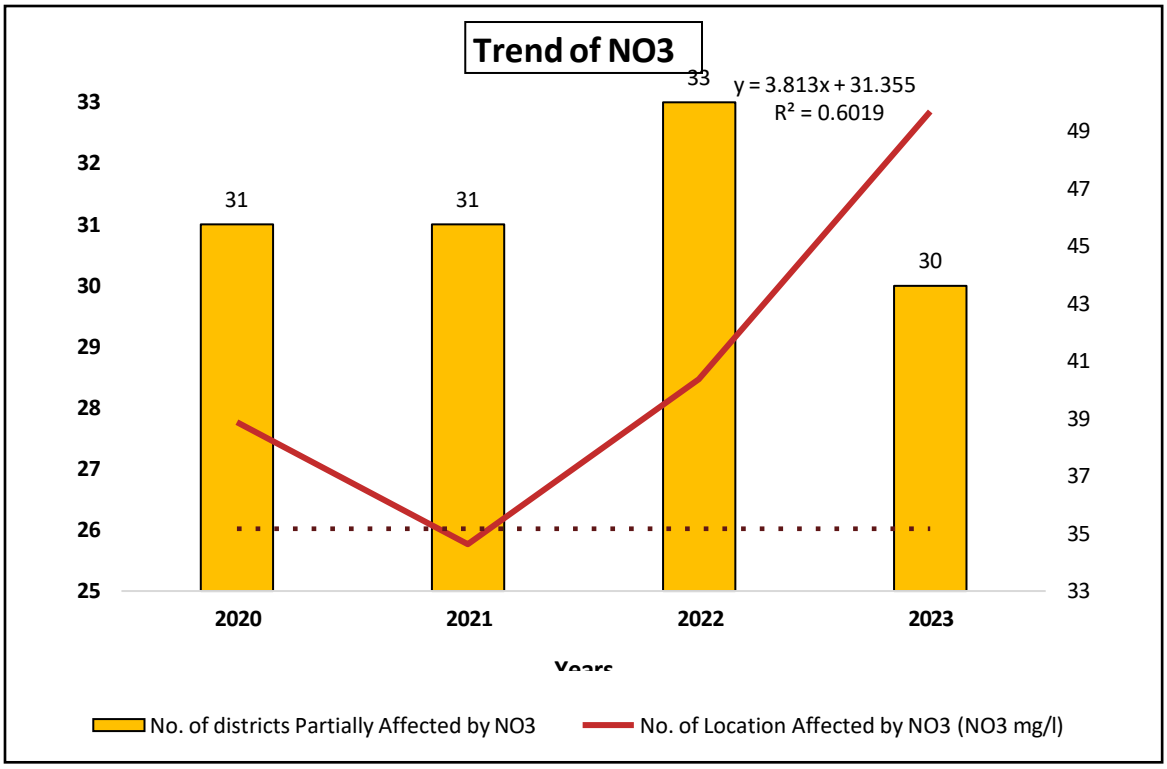
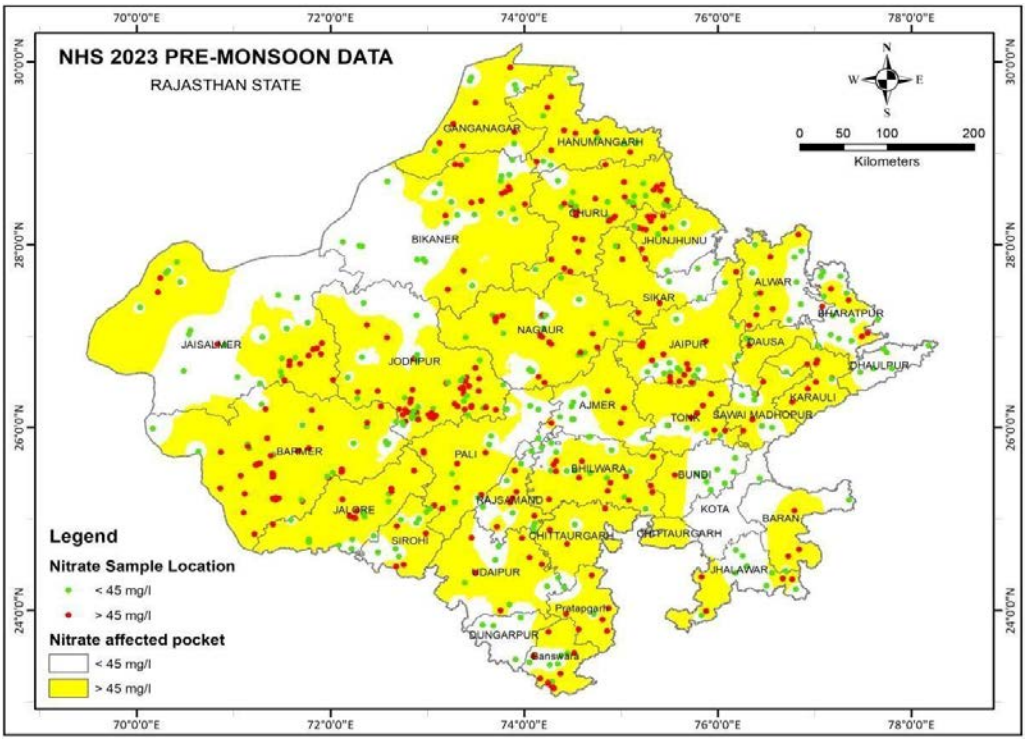


Plate -9C : Trend of Nitrate



Plat-10 : Distribution of Nitrate in Rajasthan based on NHS 2023 Data

Table 12 : Periodic variation in suitability Classes of Nitrate in groundwater of Rajasthan

Parameter	Class	Percentage of samples				Periodic variation
		2020	2021	2022	2023	PERIODIC Variation 2020-2023
NITRATE		n=(640)	n=(774)	n=(809)	n=(630)	
	< 45 mg/l	60.46	64.08	58.47	50.32	10.14
	> 45 mg/l	39.54	35.92	41.53	49.68	-10.14

Table -12A : Percent of locctions and Number of districts nitrate affected since 2020-2023

No. of districts	year	No. of districts	% of locations affected by NO3
31	2020	**31**	**38.88**
31	2021	**31**	**34.63**
33	2022	**33**	**40.36**
30	2023	**30**	**49.68**

Table 12B: District wisepercent Range and distribution of Nitrate in shallow GW of Rajasthan

S.No	district	No.of samples analysed	Permissible limit (45 mg/l)	Min	Max.	Mean	<45	>45
1	AJMER	14	45	0	556	97	57.14	42.86
2	ALWAR	15	45	5.4	148	54	60.00	40.00
3	BANSWARA	14	45	1.5	115	58	42.86	57.14
4	BARAN	5	45	20	72	46	40.00	60.00
5	BARMER	54	45	0	601	109	33.33	66.67
6	BHARATPUR	18	45	1.3	156	42	72.22	27.78
7	BHILWARA	27	45	1.1	891	96	51.85	48.15
8	BIKANER	37	45	2.6	390	62	67.57	32.43
9	BUNDI	9	45	1	129	20	88.89	11.11
10	CHITTAURGARH	5	45	0.53	525	135	40.00	60.00
11	CHURU	44	45	2	1180	215	36.36	63.64
12	DAUSA	10	45	1	794	130	60.00	40.00
13	DHAULPUR	6	45	2.6	35	19	100.00	0.00
14	DUNGARPUR	4	45	2.4	26	15	100.00	0.00
15	GANGANAGAR	11	45	1	275	93	54.55	45.45
16	HANUMANGARH	16	45	2.1	775	177	43.75	56.25
17	JAIPUR	32	45	1.6	266	80	43.75	56.25
18	JAISALMER	33	45	1	590	105	60.61	39.39
19	JALORE	23	45	1	370	83	52.17	47.83
20	JHALAWAR	12	45	0.49	165	51	66.67	33.33
21	JHUNJHUNU	19	45	1	360	97	36.84	63.16
22	JODHPUR	72	45	2	880	103	43.06	56.94
23	KARAULI	11	45	0.21	398	95	36.36	63.64
24	KOTA	1	45	14.2	14.2	14	100.00	0.00
25	NAGAUR	39	45	1	545	106	51.28	48.72
26	PALI	19	45	1.72	537	120	52.63	47.37
27	PRATAPGARH	7	45	22	130	73	14.29	85.71
28	RAJSAMAND	15	45	1.3	137	39	60.00	40.00
29	S. MADHOPUR	11	45	0.22	200	58	54.55	45.45
30	SIKAR	8	45	5.2	190	79	50.00	50.00
31	SIROHI	13	45	1	400	76	61.54	38.46
32	TONK	14	45	1.5	440	98	42.86	57.14
33	UDAIPUR	12	45	1.4	213	67	50.00	50.00
		630						

Table 12C : Comparative Change 2020-2023 in number of locations having Nitrate > 45 mg/I

S.No.	District	No. of locations having Nitrate > 45 mg/I			
		2020	2021	2022	2023
1	AJMER	6	10	12	6
2	ALWAR	0	3	10	6
3	BANSWARA	9	12	9	8
4	BARAN	7	4	6	3
5	BARMER	37	19	25	36
6	BHARATPUR	2	4	12	5
7	BHILWARA	11	25	17	13
8	BIKANER	8	10	16	12
9	BUNDI	2	1	2	1
10	CHITTAURGARH	6	5	6	3
11	CHURU	7	17	20	28
12	DAUSA	0	2	5	4
13	DHAULPUR	2	4	6	0
14	DUNGARPUR	3	2	2	0
15	GANGANAGAR	5	16	6	5
16	HANUMANGARH	7	8	11	9
17	JAIPUR	18	22	23	18
18	JAISALMER	12	10	11	13
19	JALORE	5	2	10	11
20	JHALAWAR	5	12	11	4
21	JHUNJHUNU	3	4	7	12
22	JODHPUR	21	18	31	41
23	KARAULI	8	5	8	7
24	KOTA	1	0	2	0
25	NAGAUR	9	7	16	19
26	PALI	5	7	7	9
27	PRATAPGARH	8	5	6	6
28	RAJSAMAND	11	0	6	6
29	S. MADHOPUR	6	7	8	5
30	SIKAR	1	19	5	4
31	SIROHI	7	5	7	5
32	TONK	6	5	5	8
33	UDAIPUR	15	8	11	6
		253	278	339	313

Remedial Measures for Nitrate

For removal of nitrate both non-treatment techniques like blending and treatment processes such as ion- exchange, reverse osmosis, biological denitrification and chemical reduction are useful. The most important thing is that neither of these methods is completely effective in removing all the nitrogen from the water.

a) Methods involving no treatment: In order to use any of these options the nitrate problem must be local- scale. Common methods are –

- Raw water source substitution
- Blending with low nitrate waters

This greatly reduces expenses and helps to provide safer drinking water to larger numbers of people.

b) **Methods involving Treatment:**

They are as follows

- Adsorption/Ion Exchange
- Reverse Osmosis
- Electrodialysis
- Bio-chemical Denitrification (By using denitrifying bacteria and microbes) Catalytic Reduction/Denitrification (using hydrogen gas)

The mechanism of nitrate pollution in subsurface porous unconfined/confined aquifer is governed by complex biogeochemical processes. Apart from recharge conditions, groundwater chemistry may be impacted by the mineral kinetics of water-rock interactions. Consequently, suitable nitrate removal technologies should be selected. Nitrate is a very soluble ion with limited potential for co-precipitation or adsorption. This makes it difficult such as chemical coagulation, lime softening and filtration which are commonly used for removing most of the chemical pollutants such as fluoride, arsenic and heavy metals.

According to King et al., 2012 nitrate treatment technologies can be classified in two categories in two categories, i.e. nitrate reduction and nitrate removal options. Nitrate removal technologies involve physical processes that does not necessarily involve any alteration of the chemical state of nitrate ions. Bio-chemical reduction options aim to reduce nitrate ions to other states of nitrogen, e.g. ammonia, or a more innocuous form as nitrogen gas. In-situ bioremediation is also effectively used in used in nitrate treatment of contaminated groundwater. Reverse Osmosis, catalytic reduction and blending are effective methods for nitrate removal from groundwater. For nitrate removal, operating trans-membrane pressure of RO unit generally ranges from 20 to 100 bar.

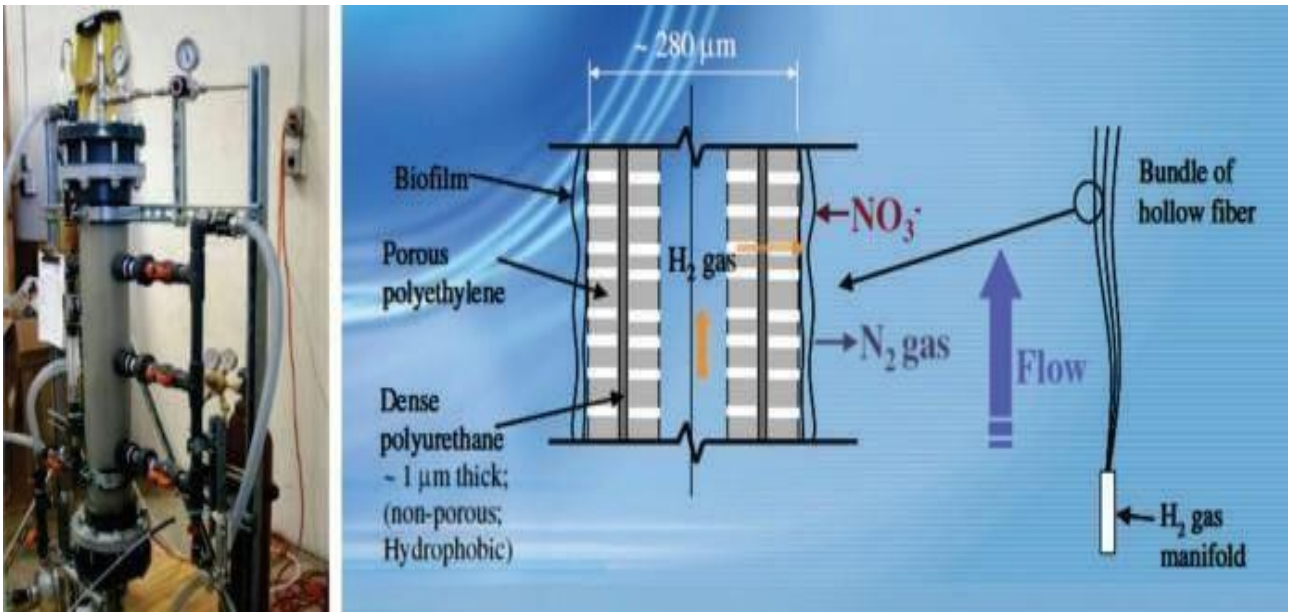


Plate-11 Advanced Nitrate Reduction Hollow Fiber Membrane Reactor (Source: Hand Book for Drinking Water Treatment, JJM, Ministry of Jal Shakti, Gov. of India)

FLUORIDE-

Fluorine does not occur in the elemental state in nature because of its high reactivity. It exists in the form of fluorides in a number of minerals of which Fluorspar, Cryolite, Fluorite & Fluorapatite are the most common.Most of the fluoride found in groundwater is naturally occurring from the breakdown of rocks and soils or weathering and deposition of atmospheric particles. Most of the fluorides are sparingly soluble and are present in groundwater in small amount. The type of rocks, climatic conditions, nature of hydro geological strata and time of

contact between rock and the circulating groundwater affect the occurrence of fluoride in natural water. BIS has recommended a desirable limit of 1.0 mg/l of fluoride concentration in drinking water and maximum permissible limit of 1.5 mg/l in case no alternative source of drinking water is available. It is well known that small amount of fluoride (**upto**1.0 mg/l) have proven to be beneficial in reducing tooth decay.However, high concentrations (>1.5mg/l) have resulted in staining of tooth enamel while at still higher levels of fluoride (> 5.0 mg/l) further critical problems such as stiffness of bones occur. Water having fluoride concentration more than 1.5mg/l is not suitable for drinking purposes. High Fluoride >1.5mg/l is mainly attributed due to geogenic conditions. The fluoride content in ground water from observation wells in a major part of the State is found to be less than 1.0 mg/l. Fluoride (F) values higher than the BIS permissible limit (>1.5 mg/l) for drinking water, have been observed in western, north western, central areas and a few places lying in eastern and southern areas of the State, thus, making the ground water non-potable. The southern, south

western and north-eastern areas in the State have a better ground water quality with respect to Fluoride as the concentrations at point locations are within permissible limit assigned by BIS(<1.5 mg/l).Fluoride in small amounts in drinking water is beneficial for the dental health while in large amounts it is injurious. The fluoride content in ground water ranges from 0.01 to 22 mg/L. BIS recommends that fluoride concentration up to 1.0 mg/L in drinking water is desirable, up to 1.50 mg/L it is permitted and above 1.50 mg/L is injurious. Classification of samples based on this recommendation, it is found that

38.73 % samples have fluoride in desirable range, 17.62 % in the permissible and the remaining

43.65 % have fluoride above 1.50 mg/L. Map showing spatial distribution (Figure 7) of fluoride contents in ground water indicates that ground waters with fluoride above 1.50 mg/L are found mainly in Pali 73.68 %, Jalore 69.57%, Nagaur 66.67% jhunjhunu 63.16% , Sirohi 61.54 % , Jodhpur 61.11
% Jaipur 53.11 %, , Churu 47.53% , Jaisalmer 45.45%, Sawaimadhop[ur 45.45% and ajmer and Banswara

42.86 % each Barmer 42.59 % and Chittorgarh 40% districts of the State. Minimum value of fluoride has been observed 0.01 mg/l at Angai in Daulpur district & highest values of fluoride (18.50 mg/l) have been observed at Birdhwal Ganganagr,17.20 mg/l at Manj form house in

Jodhpur district ,17.10 mg/l at Sujangarh in Churu district and 17.0 mg/l Nandiya in Jodhpur district in the state. There is no sample was found beyond the permissible limit in Baran and Kota It is worth mentioning that high fluoride waters are encountered in areas where high salinity is encountered. figure given below is shows trend of fluoride in Rajasthan since 2020-2023.The major reason for high fluoride is due to geogenic source and less rainfall recharge in ground water, Over exploitation of ground water is also reason for high f in ground water. Distriubution of fluoride in 2023 is given in below figure and trend of fluoride is given below in plate -12 and 13 respectively. Periodic variation in suitability Classes of Nitrate in groundwater of Rajasthan is gien below in table -12. Percent of locctions and number of districts nitrate affected since 2020-2023 is given below in table -12A. District wise percent range and distribution of fluoride in shallow GW of Rajasthan and Comparative Change in number of Locations having F > 1.5 mg/I periodic variation in suitability Classes of Fluoride in groundwater of Rajasthan and percent of locctions and Number of districts fluoride affected since 2020-2023 are given in table 13,13A, 13B and 13C. It has been observed (Table -13A) that total number of districts affected by high fluoride has increased from **176 in** 2020 to **275** in 2023.Numbers is show more in comparative to 2022 due to revise WQ -2023 policy.

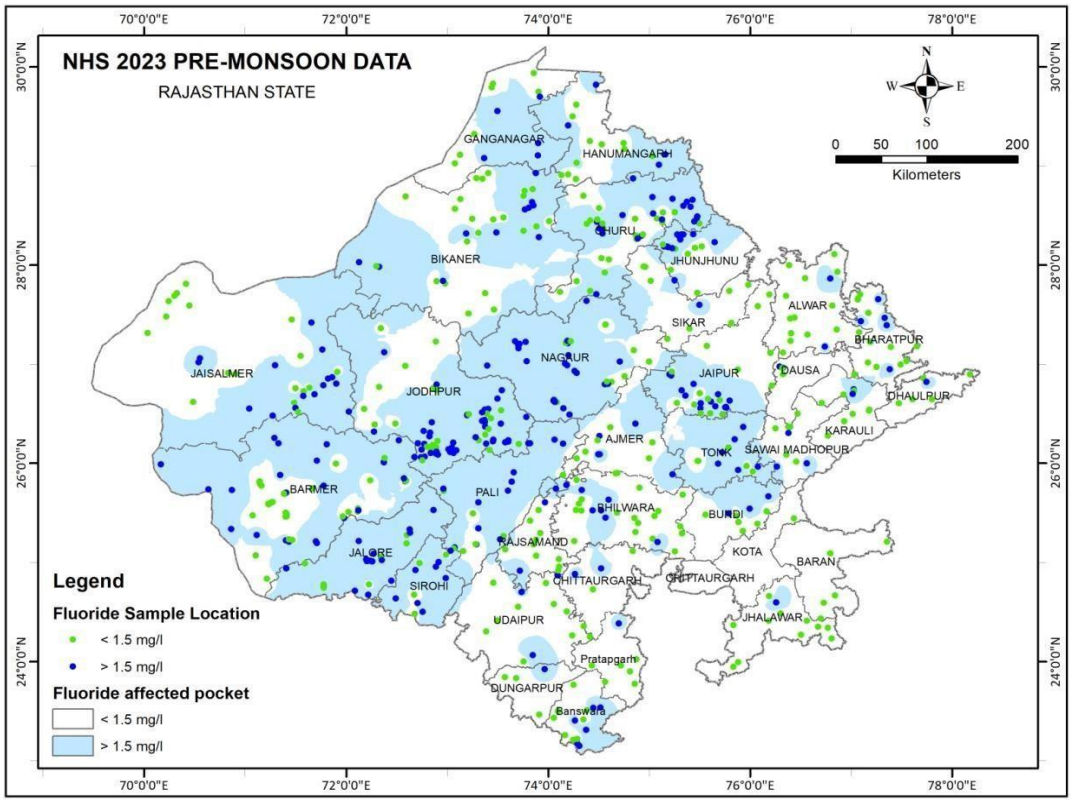


Plate- 12 :- Distribution of Fluoride in Rajasthan May 2023

Table 13: District wise Range and distribution of Fluoride in shallow GW of Rajasthan

	district	No.of samples analysed	Permissible limit (1.5 mg/l)	Min	Max.	Mean	< 1.5 mg/l	> 1.5 mg/l
1	AJMER	14	1.5	0.172	5	1.60	57.14	42.86
2	ALWAR	15	1.5	0.11	5.15	0.82	86.67	13.33
3	BANSWARA	14	1.5	0.4	3	1.41	57.14	42.86
4	BARAN	5	1.5	0.9	1.3	1.09	100.00	0.00
5	BARMER	54	1.5	0.1	10	1.70	57.41	42.59
6	BHARATPUR	18	1.5	0.013	2.5	1.06	66.67	33.33
7	BHILWARA	27	1.5	0.02	4.45	1.07	77.78	22.22
8	BIKANER	37	1.5	0.1	15	2.56	64.86	35.14
9	BUNDI	9	1.5	0.72	3.15	1.41	66.67	33.33
10	CHITTAURGARH	5	1.5	0.147	1.96	1.17	60.00	40.00
11	CHURU	44	1.5	0.03	17.1	2.21	52.27	47.73
12	DAUSA	10	1.5	0.091	3.59	1.12	80.00	20.00
13	DHAULPUR	6	1.5	0.007	2.82	0.81	83.33	16.67
14	DUNGARPUR	4	1.5	0.43	2.32	0.98	75.00	25.00
15	GANGANAGAR	11	1.5	0.4	18.2	3.56	63.64	36.36
16	HANUMANGARH	16	1.5	0.16	15.6	2.78	68.75	31.25
17	JAIPUR	32	1.5	0.012	6.3	1.97	46.88	53.13
18	JAISALMER	33	1.5	0.4	6.6	1.65	54.55	45.45
19	JALORE	23	1.5	0.38	8.4	2.99	30.43	69.57
20	JHALAWAR	12	1.5	0.45	3.5	0.94	91.67	8.33
21	JHUNJHUNU	19	1.5	0.02	5.74	2.15	36.84	63.16
22	JODHPUR	72	1.5	0.2	17.2	3.85	38.89	61.11
23	KARAULI	11	1.5	0.145	3.9	1.04	81.82	18.18
24	KOTA	1	1.5	0.64	0.64	0.64	100.00	0.00
25	NAGAUR	39	1.5	0.284	10	2.46	33.33	66.67
26	PALI	19	1.5	0.2	6.51	2.78	26.32	73.68
27	PRATAPGARH	7	1.5	0.1	1.8	0.55	85.71	14.29
28	RAJSAMAND	15	1.5	0.032	2.5	1.09	66.67	33.33
29	SAWAI MADHOPUR	11	1.5	0.48	2.3	1.44	54.55	45.45
30	SIKAR	8	1.5	0.1	2.8	0.94	87.50	12.50
31	SIROHI	13	1.5	0.2	3.6	1.89	38.46	61.54
32	TONK	14	1.5	0.3	5.3	1.63	64.29	35.71
33	UDAIPUR	12	1.5	0.026	3.32	0.88	83.33	16.67
		630						43.65

Table 13A: Comparative Change in number of Locations having F > 1.5 mg/l

S.No.	District	No. of locations having Fluoride > 1.5 mg/l			
		2020	2021	2022	2023
1	AJMER	12	7	9	6
2	ALWAR	1	2	4	2
3	BANSWARA	8	0	7	6
4	BARAN	0	0	0	0
5	BARMER	26	5	17	23
6	BHARATPUR	11	4	6	6
7	BHILWARA	9	5	7	6
8	BIKANER	8	14	13	13
9	BUNDI	3	3	5	3
10	CHITTAURGARH	0	1	0	2
11	CHURU	3	8	11	21
12	DAUSA	2	1	3	2
13	DHAULPUR	1	0	0	1
14	DUNGARPUR	2	3	2	1
15	GANGANAGAR	4	1	8	4
16	HANUMANGARH	2	2	3	5
17	JAIPUR	17	13	5	17
18	JAISALMER	9	3	13	15
19	JALORE	3	4	11	16
20	JHALAWAR	1	3	2	1
21	JHUNJHUNU	2	2	5	12
22	JODHPUR	11	10	25	44
23	KARAULI	3	1	3	2
24	KOTA	1	0	1	0
25	NAGAUR	7	2	9	26
26	PALI	7	6	10	14
27	PRATAPGARH	1	0	1	1
28	RAJSAMAND	5	1	6	5
29	S. MADHOPUR	3	3	9	5
30	SIKAR	0	14	2	1
31	SIROHI	4	2	7	8
32	TONK	8	8	7	5
33	UDAIPUR	2	3	3	2
	Total	176	131	214	275

Table 13B 0: Periodic variation in suitability Classes of Fluoride in groundwater of Rajasthan

Par ameter	Class	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	PERIODIC Variation 2020-2023
		n=(640)	n=(774)	n=(809)	n=(630)	
Fluoride	< 1 mg/l	58.66	69.58	55.71	38.73	19.93
	1-1.5 mg/l	13.84	13.5	18.39	17.62	-3.78
	>1.5 mg/l	27.50	16.92	26.45	43.65	-17.37

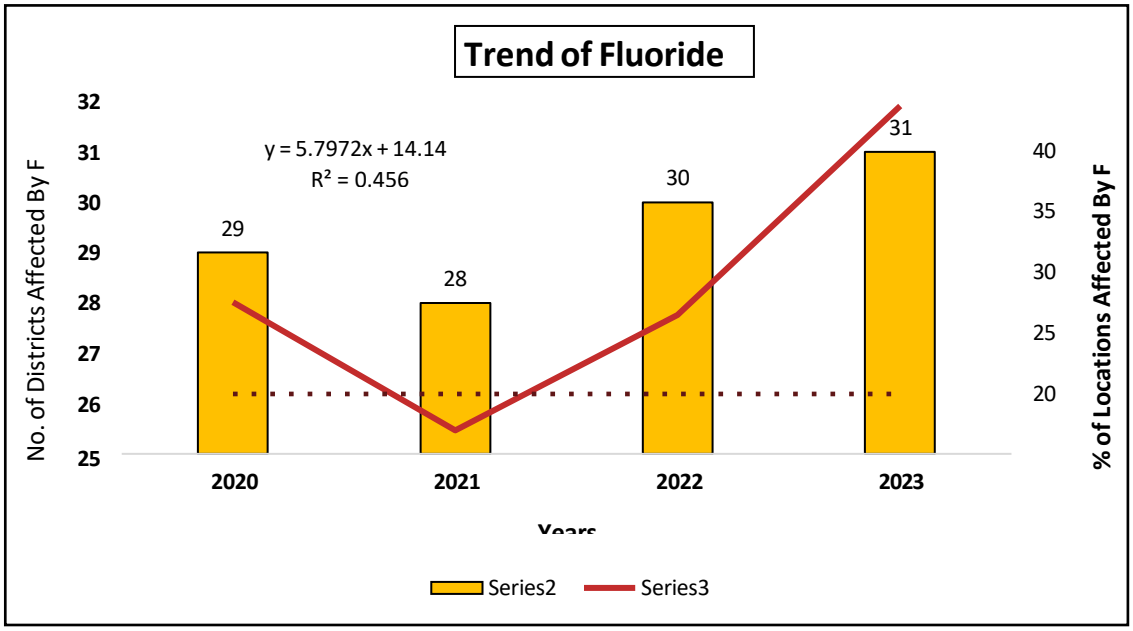


Plate- 13: Trend of fluoride since 2020 to 2023

Table -13C : Percent of locctions and Number of districts fluoride affected since 2020-2023

No. of Districts	year	% oflocations affected by F
29	2020	*27.50*
28	2021	*16.92*
30	2022	*26.45*
31	2023	43.65

Remedial Measures for Fluoride

The fluoride remedial measures broadly adopted are ex-situ techniques. They can be classified into three major categories.

(a) Adsorption and ion exchange

This technique functions on the adsorption of fluoride ions onto the surface of an active agent such as activated alumina, red mud, bone char, brick pieces column, mud pot and natural adsorbents where fluoride is removed by ion exchange or surface chemical reaction with the solid bed matrix.

Activated alumina: Activated alumina is a highly porous aluminum oxide exhibiting high surface area. Alumina has a high preference for fluoride compared to other anionic species, and hence is an attractive adsorbent. The crystal structure of alumina contains cation lattice discontinuities giving rise to localized areas of positive charge which makes it attract various anionic species. It also does not shrink, swell, soften nor disintegrate when immersed in water.

The maximum absorption capacity of activated alumina for fluoride is found to be 3.6 mg F/g of alumina.

Ion-Exchange resins: Synthetic chemicals, namely, anion and cation exchange resins have been used for fluoride removal. Some of these are Polyanion (NCL), Tul-sion A - 27, Deacedite FF (IP), Amberllte IRA 400, LewatitMIH - 59, and AmberliteXE - 75. These resins have been used in chloride and hydroxy form. The fluoride exchange capacity of these resins depends upon the ratio of fluoride to total anions in water.

(b) Coagulation-precipitation

Precipitation methods are based on the addition of chemicals (coagulants and coagulant aids) and the subsequent precipitation of a sparingly soluble fluoride salt as insoluble. Fluoride removal is accomplished with separation of solids from liquid. Aluminium salts (eg. Alum), lime, Poly Aluminium Chloride, Poly Aluminium Hydroxy sulphate and Brushite are some of the frequently used materials in defluoridation by precipitation technique. The best example for this technique is the famous Nalgonda technique.

Nalgonda Technique

Nalgonda technique involves addition of Aluminium salts, lime and bleaching powder followed by rapid mixing, flocculation, sedimentation, filtration and disinfection. It is opined that this technique is preferable at all levels because of the low price and ease of handling, is highly versatile and can be used in various scales from household level to community scale water supply.

The Nalgonda technique(Plate-14) can be used for raw water having fluoride concentration between 1.5 and 20 mg/L and the total dissolved solids should be <1500 mg/L, and total hardness < 600 mg/L. The alkalinity of the water to be treated must be sufficient to ensure complete hydrolysis of alum added to it and to retain a minimum residual alkalinity of 1 - 2 meq/L in the treated water to achieve a pH of 6.5 - 8.5 in treated water. Several researchers have attempted to improve the technique by increasing the removal efficiency of fluoride using Poly Aluminium Chloride (PAC) and Poly Aluminium Hydroxy Sulphate (PAHS).

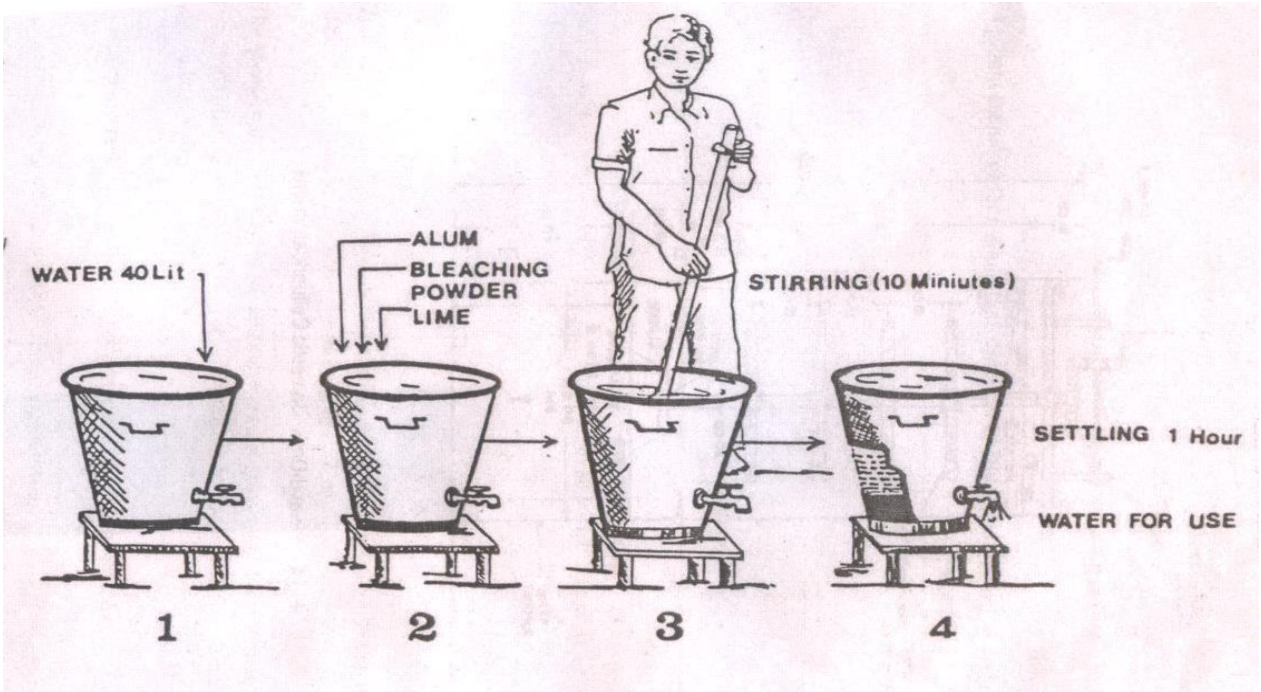


Plate-14 Defluoridation at Domestic level

(c) Membrane techniques

Reverse osmosis, nanofiltration, dialysis and electro dialysis are physical methods that have been tested for defluoridation of water. Though they are effective in removing fluoride salts from water, however, there are certain procedural disadvantages that limit their usage on a large scale.

Total Hardness (TH)

It is primarily determined by sum of calcium and magnesium ions expressed as calcium carbonate. Other substances such as iron, manganese, aluminum, strontium, zinc may also contribute to a very small extent due to low solubility. An inverse correlation between hardness of water & cardiovascular diseases (Heart, hypertension and stroke) has been shown. High values may cause calcification of arteries, urinary concretions and stomach disorder.

Out of 630 samples analysed, 17.40 % samples are within Acceptable limit of 200 mg/ l for total hardness. 26.80 % samples have concentration beyond permissible limit while 56.03 % samples fall within acceptable and permissible limits. Total hardness above 600 mg/l is found in Hanumangarg (43.75%), Nagaur (43.59%), Bharatpur (40.00%), Churu(38.64%), Bhilwara (37.04 %), Gaanganagar, (36.36 %), Jodhpur (30.56%),Jalore (30.43%), districts have Total Hardness concentration beyond permissible limit.. In Banswara, Chittaurgarh, Dhaulpur, Dungarpur, Jhunjhunu, Jhalawara, Sikar & Kota districts none of samples have Total Hardness concentration beyond permissible limit. The minimum value of hardness as 50 mg/l has been found at Kasturia in Bikaner district. The maximum value 6400 mg/l has been observed at Taranagarh in Churu district. *Trend of total hardness in Rajasthan, Percent of locctions and Number of districts Total hardness affected since 2020-2023 is given below in table-14,14Aand Plate-15*

Table- 14 : Trend of Total Hardness since 2020-2023 in Rajasthan

Parameter	Class	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		(n=640)	(n=774)	(n=809)	(n=630)	
TOTAL HARDNESS	<200 mg/l	29.06	20.8	15.95	17.14	11.92
	200-600	54.06	61.11	59.83	56.03	-1.97
	>600	16.89	18.09	24.22	26.83	-9.94

Table -14A : Percent of locctions and Number of districts Total hardness affected since 2020-2023

No. of districts	year	No. of districts	
17	2020	*27*	16.89
16	2021	*32*	18.09
17	2022	*30*	24.22
19	2023	*25*	26.83

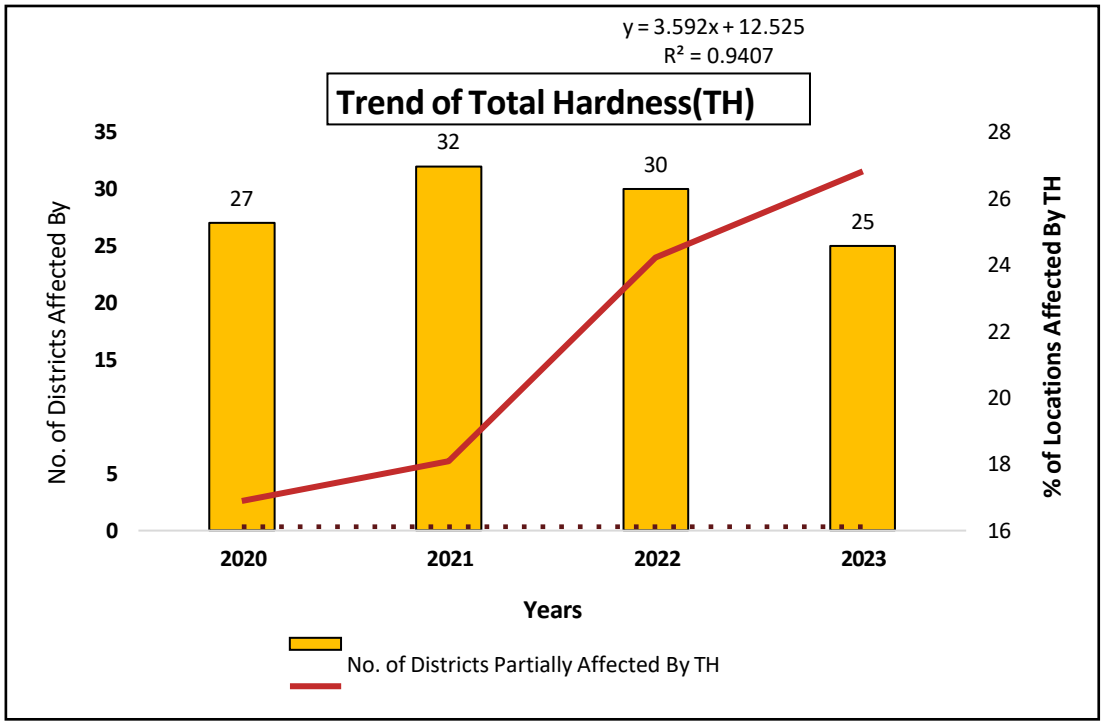


Plate -15 :Trend of Total Hardness in Rajastha 2020-2023

Removal of total hardness

A few methods to remove hardness from water can be used .

- Chemical Process of Boiling Hard Water.
- Adding Slaked Lime (Clark's Process)
- Adding Washing Soda.

- Calgon Process.
- Ion Exchange Process.
- Using Ion Exchange Resins.

CARBONATE (TEMPORARY) HARDNESS also known as Ca Bicarbonate

$Ca(HCO3)2$ + Mg Bicarbonate $Mg(HCO3)2$.

Removal by Boiling or adding Lime

NON-CARBONATE (PERMANENT) HARDNESS Calcium Sulfate $CaSO4$ +

Magnesium Sulfate $MgSO4$ & Calcium Chloride $CaCl2$ + Magnesium Chloride $MgCl2$.

Removal by Lime-soda, Zeolite or Demineralization Processes.

Calcium (Ca)

It is always found in combination in limestone, marble and chalk. Its most common compounds are limestone, gypsum, fluorite; also calcium carbide, chloride, hypochlorite. Calcium is essential for human body. Its low content in soft water has been linked with rickets & defective teeth. Its excess may cause stones in kidney or bladder. Gout, Rheumatism etc. are also linked with its high concentration.

There is no cause of concern about the calcium hazard as only 6.66 % samples are beyond the permissible limit of 200 mg/l, 27.78 % samples are lies between acceptable & permissible limits of BIS. and 65.556 % samples are within acceptable limit of BIS. The minimum value of calcium has been observed as 8.0 mg/l (Near Romji Garments) in Tonk distric. Maximum value of 1064 mg/l Tonk (Raivens Industry) in Tonk district.

Magnesium (Mg)

It is never found as a free element. It constitutes a large deposit as magnesite & common rock forming dolomite. Presence of magnesium is beneficial for heart & nervous system. However higher concentrations have laxative and diuretic effect. Only 25.20 % of samples have magnesium concentration beyond permissible limit of 100 mg/l. 22.70% samples fall within Acceptable limit and 52.06 % samples are lies between acceptable & permissible limits of BIS. None of the sample in Pratapgarh & Dungarpur districts have magnesium value beyond permissible limit. Mg value beyond permissible limit is found in well water of Nagaur (46.15%), Hanumangarh (43.75 %), Churu (38.63%), Tonk (35.71%) districts , Barmer 31.48 % & Jaipur,Jodhpur , Udaipur 25% each districts. The minimum value of Mg as 2.0 mg/l has been found at Palri (M) in Sirohi District Loha in Churu and maximum value 1070 mg/l at Taranagar in Churu district. There is no sample was found beyond the permissible limit in Banswara,Baran,Chittaurgarh,Dhaulpur, Dungerpur, Kota and Sikar districts.

8.62.1Trace Elements in Groundwater :

Trace elements are generally present in small concentration in natural water system. Their occurrence in groundwater and surface water can be due to natural sources such as dissolution of naturally occurring minerals containing trace elements in the soil zone or the aquifer material or to human activities such as mining, fuels, smelting of ores and improper disposal of industrial wastes.

Trace metals like Fe, Mn, Cu, Zn etc are essential nutrients and are very important for the proper functioning of the biological system and their deficiency or excess in the human system can lead number of disorders. However, certain trace elements such as As, Cd, and Hg are not only biologically non essential but definitely toxic. In case of many heavy metals, bio-magnification occurs through food chain so are known to be identified to cause persistent environment contamination and toxic to most form of life.

Arsenic:

Arsenic is generally distributed in more than 320 minerals, and it's commonly found in arsenopyrite (FeAsS), orpiment (As_2S_3), realgar (As_2S_2), and pyrite solid solutions (FeS_2). The major sources of arsenic in natural waters include arsenic minerals, together with a once widespread use of arsenic in wood preservatives, glass manufacture, electronics, catalysts, alloys, feed additives, veterinary chemicals, pigments, insecticides and herbicides. About 70% of all arsenic uses are in pesticides.

Arsenic can form both inorganic and organic compounds. It occurs with valence states of

-3,0, +3 and +5, nevertheless, the valence states of -3 and 0 occur only rarely in nature. In sea water and surface water, arsenite and arsenate constitute the dominant species.

Geomaterials such as clays, carbonaceous materials, and oxides of iron, aluminum, and manganese are sediment components that may participate in adsorptive reactions with arsenic.As(III) is considered to be more toxic and more difficult to remove from water than As(V). Arsenic is found in low concentration, generally below the detection limit at many places. Its ranges is BDL to 0.006 mg/l As concentration is less than 10 µg/l (BIS limit for drinking water) is found in all the samples analysed .we concluded that no contamination in ground water in respect to arsenic parameter.

Copper

The concentration of copper in water depends on pH, alkalinity and other anions in solution. It imparts colour and undesirable taste to drinking water. It is an essential element in human metabolism, but intake of excessively large doses may lead to severe mucosal irritation, renal damage and depression. It also enhances corrosion of aluminium and zinc utensils and fittings. BIS has recommended aacceptable limit of 0.05mg/l and in the absence of an alternate source of drinking water supplies, a maximum permissible limit of 1.5mg/l in drinking water. Copper concentration in all samples is found well within the permissible limit of BIS. It ranges from less than detectable concentration to 0.016 mg/l.

Lead

It is a toxic constituent that accumulates in skeletal structure of man and animal. Naturally, lead occurs in the earth's crust at an average concentration of 16mg/Kg. In unpolluted waters, it has been found to be less than 10µg/l (Hem, 1970). In industrialized areas, the higher values have been recorded due to contamination with industrial effluents. The major source activities that can possibly contribute lead into the environment are weathering of rocks, use of lead compounds as insecticide, occurrence of lead as an impurity in fertilizers and/or soil amendments, smelting operations of lead ores, sulfide ores, Plumbing operations, waste effluents from industries such as paint, batteries, and tanneries and use of lead compounds as anti-knock agents in fuels used in automobiles. The maximum concentration

of lead in drinking water has been set at 0.01mg/l (BIS 2012). The high concentration may result in loss of appetite, fatigue, irritation, headache, vomiting, convulsion and death. Lead is found in significant number of well waters.

It is found to range from below detection limit to high concentration 0.14 mg/l at Bhagli

In Jalore district . About 6.66 % of the wells have recorded more than 0.01mg/l of lead. Such waters are found in parts of Alwar, Barmer, Bharatpur, Churu, Dhalpur, Hanumangarh, Jaisalmer, Nagaur and Sawaimadhopur one location each and Jalore(3- locations) and Jodhpur (2-locations . These waters are not suitable for consumption.

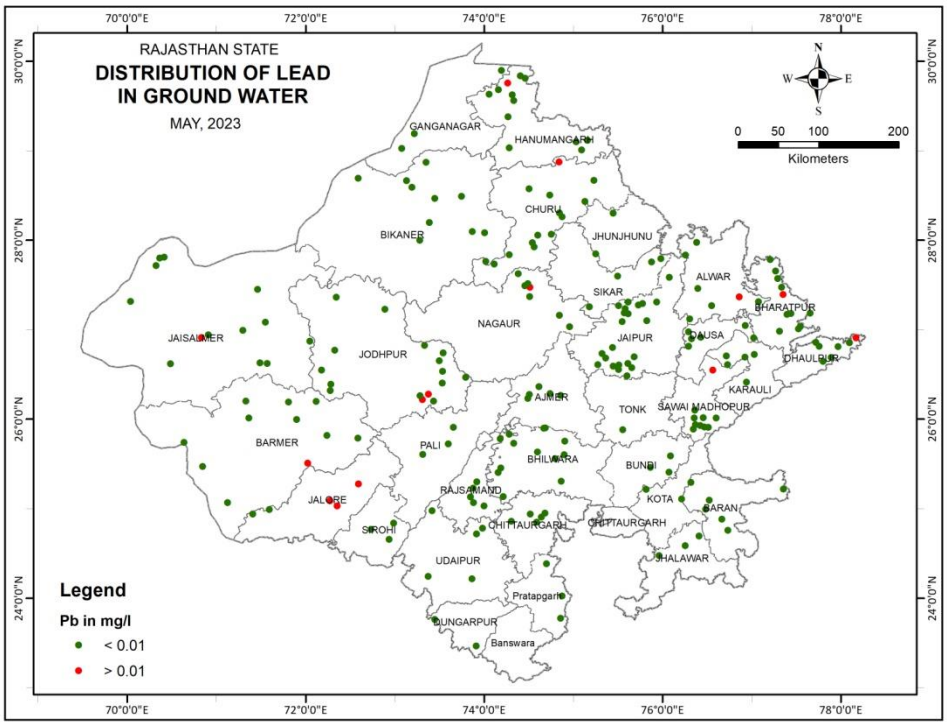


Plate- 16 : DISTRIBTION OF LEAD IN GROUND WATER OF RAJASTHAN

Iron

Iron is an essential nutrient for man, animal and plants. It occurs in ground water in both the ferrous (Fe^{2+}) and ferric (Fe^{3+}) state. Under reducing conditions in water, the mobile ferrous ion is present but upon exposure to air, it is oxidized to the less mobile form and gets precipitated as the ferric ion. In water, such iron precipitates produce reddish brown stains on porcelain, enamel, plumbing, and clothing. The solubility of iron increases with decreasing pH.Geogenically, it is derived from crystal weathering especially from minerals

of igneous Rocks and sulfide ores (pyrite, Fe2S) but also from sedimentary and metamorphic rocks. Anthropogenically, industrial wastes, the burning of coke and coal, acid mine drainage, mineral processing and corrosion of iron and steel may contribute iron to environment. Atmospheric transport may provide as much as 0.05mg/L of iron in rainfall.High concentration of iron in drinking water causes bitter-sweet astringent taste and inky flavour which is objectionable. The Bureau of Indian Standards, based on aesthetic and economic considerations, has given aacceptable limit of 1.0mg/l.

The concentration of iron in ground water of the State ranges from below detection level to

2.267 mg/l (Hurda, district Bhilwara).Most of the shallow water samples have iron content within the acceptable limit of 1.0mg/l, only about 3.55% water wells recorded its concentration more than more than acceptable limit 1.0mg/l इन 2023-24 l. Higher concentration of iron (Permissible limit of BIS -greater than 1.0 mg/l) is given below table l Waters high in iron content are found in some parts of districts Ajmer, Bhilwara, Chittaurgarh,Jaipur and Sikar .These waters are not suitable for domestic purpose. 7.50% out of 669 locations in 2019-20 recorded iron concentration more than permissible limit and in 2023-24 only 3.55% water wells recorded its concentration more than acceptable limit 1.0mg/l given in below table 15 . Due to new WQ policy in 2023, number of locations are different in comparison of 2019 and 2023. ***distribtion of iron in ground water of Rajasthanis given below in plate 17***

Table 15 : - Higher concentration of iron (Permissible limit of BIS -greater than 1.0 mg/l).

S.No.	District	Block	Village	Source	latitude	longitude	Fe(mg/l)
1	Ajmer	Peesangan	Nasirabad	DW	26.2867	74.7403	1.442
2	Bhilwara	Hurda	Hurda	HP	25.9023	74.6881	2.267
3	Bhilwara	Sahara	Potlan	DW	25.1368	74.2174	1.491
4	Bhilwara	Raipur	Raipur	DW	25.404	74.161	1.291
5	Chittaurgarh	Chittaurgarh	Bojunda	DW	24.85	74.5889	1.442
6	Jaipur	Phagi	Madhorajpur	DW	26.577	75.656	1.117
7	Jaipur	Phagi	Lasariya	DW	26.557	75.509	1.083
8	Sikar	Neem Ka Thana	Barala	hp	27.75601	75.8799	1.986

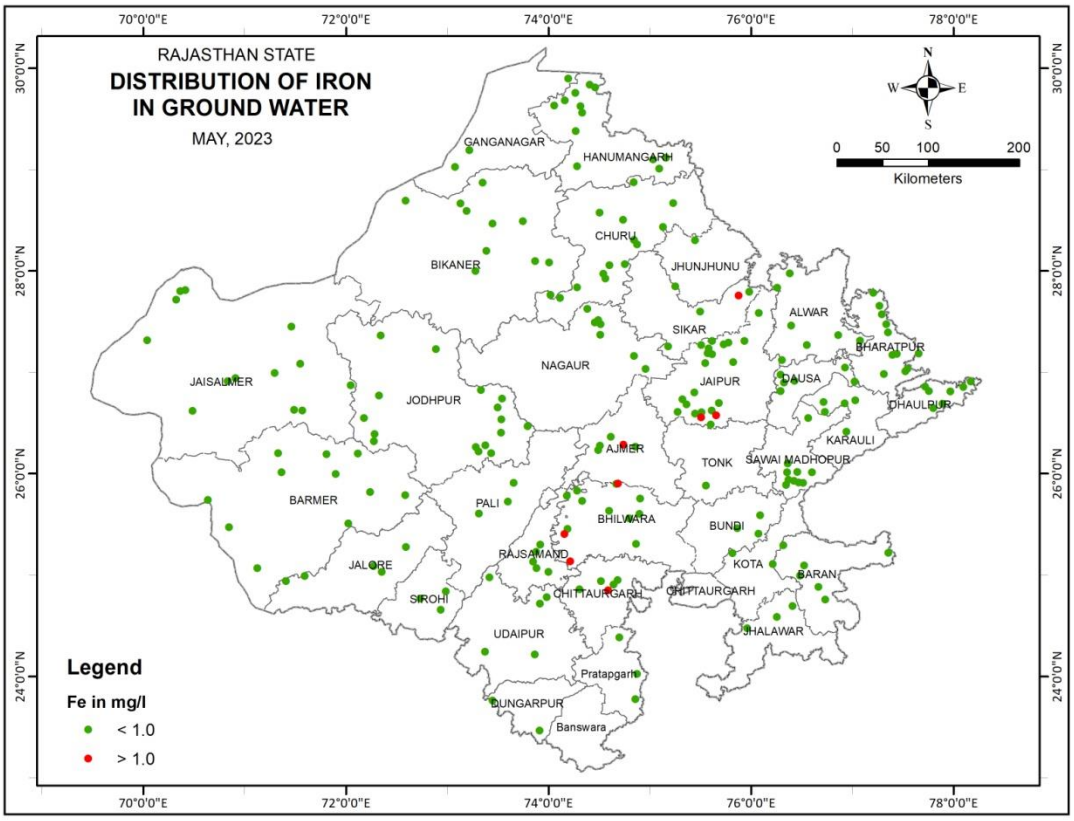


Plate- 17 : DISTRIBTION OF IRON IN GROUND WATER OF RAJASTHAN

Manganese

Manganese is similar to iron in its chemical behavior and is frequently found in association with iron. It may exist in the manganous (Mn^{2+}) form and is readily oxidized to the manganic (Mn^{4+}) form. Geogenically, soils and sediments are important sources of manganese along with metamorphic and sedimentary rocks. Minerals such as biotite mica and amphiboles contain large amounts of manganese. After plants die, the manganese that has accumulated within them is available for re-solution in runoff and in soil moisture. Anthropogenically, industrial wastes and acid-mine drainage are major sources of manganese to ground waters. Iron and steel plants also release manganese to the atmosphere. It is then deposited through atmospheric deposition. In areas where soils exhibit manganese deficiency, manganese is added to soils for proper plant growth. The solubility of manganese under aerobic environment and in the presence CO_2 cannot be more than few micrograms per liter. However, when anaerobic conditions prevail, manganese content

is likely to rise, as Mn^{2+} is quite stable under such circumstances. The probable reasons for manganese concentration beyond extended levels in observation well waters are Atmospheric deposition, Anaerobic conditions caused by flooded irrigation and Organic matter from plant debris Manganese, in small amounts, is an essential nutrient element for man, animals and for plant metabolism. The presence of substantial amounts of manganese is objectionable in laundry and textile processing because of staining qualities. The Bureau of Indian Standards has given aacceptable limit of 0.1mg/l that can be extended up to 0.3mg/l in absence of an alternative source for drinking water. Standards for manganese have been recommended on aesthetic and economic considerations. The manganese is found to be present at many places though mostly in low concentrations. It ranges from below detection limit to 0.832 mg/l 9 (Location - Deeg in district Bharatpur . A few wells (2.66 %) located in Alwar, Bharatpur, Bhilwara, Chittaurgarh & Dausa have manganese values between the acceptable(0.1mg/l) and permissible(0.3mg/l)limitsof BIS for drinking water. Only two locations (Less than 1 %) Deeg (0.832 mg/l)1 in Bharatpur district and Bapi(0.318 mg/l) in dausa district having more than permissible limit 0.3 mg/l .Distribution of Manganese in Rajasthan is given below in plate-18.

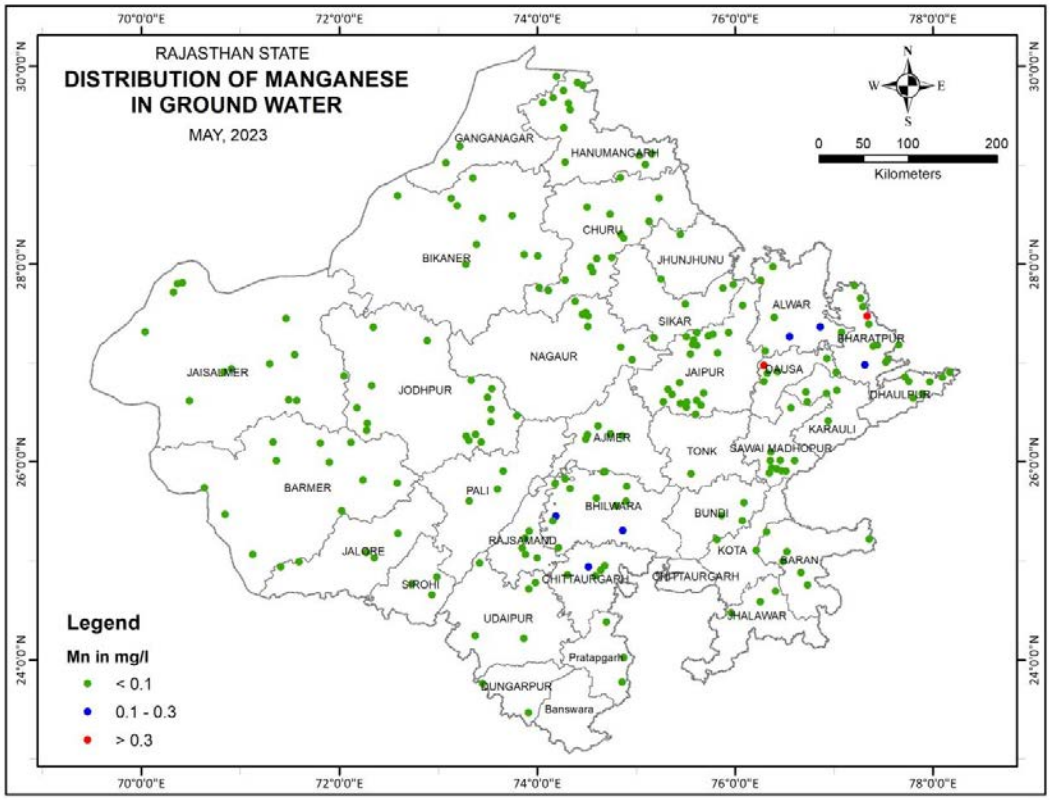


Plate- 18 : DISTRIBTION OF MANGANESE IN GROUND WATER OF RAJASTHAN

Zinc **-** Zinc occurs in traces in water because it normally forms sparingly soluble compounds and easily gets adsorbed on the sediments. It may be contributed to aquatic environment by calcareous sediments. The industrial effluents of metal plating, plumbing can also contribute it to ground water. It is also contributed by discharge from muncipal and industrial waste-water treatment plant. It is considered non- toxic but excessive intake may cause vomiting, dehydration, nausea and lethargy. Based on taste and appearance of water rather than toxicity, BIS has recommended the maximum acceptable limit of 5 mg/l and maximum permissible limit of 15mg/l. Zinc value is varies between BDL to 0.851 mg/l (Sadulshahar in Ganganagar district). In Rajasthan state, it is found that all the wells Zinc value is found within the permissible limit. The concentration above 5mg/l may cause bitter taste to water.

Uranium (U) :

Uranium is a primordial and heaviest naturally occurring radioactive element that occurs in dispersed state in the earth's crust with an average concentration of 2–4 mg kg-1. The formation of uranium accumulations is a normal geological process in granites as well as in sedimentary rocks and the commonly occurs as uraninite (uranium oxide), autunite (a hydrated calcium uranium phosphate), brannerite (uranium calcium cerium titanium oxide) and carnotite (hydrated potassium uranium vanadate).

In groundwater, Uranium is present as a result of leaching from natural deposits, release from mill tailings, emission from the nuclear industry, contribution from fly ash and commonly present in lignite, monazite and phosphate rocks The migration and/or mixing of contaminant chemicals in the groundwater are put into motion by certain drivers. These drivers can be anthropogenic factors, such as drainage, irrigation, groundwater pumping, waste or wastewater disposal from industry. Natural uranium can also be released into the environment from various Anthropogenic or man-made activities such as the use of phosphate fertilizers, pesticides, combustion of coal in thermal power plants, mining, depleted uranium from the wars.

In general, most drinking water sources have radioactive contaminants at levels that are low enough to be considered a public health. However, elevated levels of Uranium in drinking water have been reported in many parts of the world including India. BIS has set drinking water standards for Uranium in drinking water at 30 µg/L while Atomic Energy Regulatory

Board, India has prescribed the maximum limit of U in drinking water at 60 μg/L (ppb). Uranium occurs naturally in groundwater and surface water.High uranium concentration can cause impact on water, soil and health. Uranium has both natural and anthropogenic source that could lead to the aquifer. These sources include leaching from natural deposits, release in mill tailings, and emissions from the nuclear industry, combustion of coal and other fuels and the use of phosphate fertilizers that contains uranium and contribute to ground water pollution. Uranium enters in human tissues mainly through drinking water, food, air and other occupational and accidental exposures. Intake of uranium through air and water is normally low, but in circumstances in which uranium is present in a drinking water source, the majority of intake can be through drinking water.

Water with uranium concentration above the recommended maximum permissible concentration of 30 ppb (BIS,10500:2012) is not safe for drinking purposes as it can cause damage to internal organs, on continuous intake. Elevated uranium concentrations in drinking water have been associated with many epidemiological studies such as urinary track cancer as well as kidney toxicity. A recent study, found a strong correlation between uranium concentration in drinking water and uranium in bone, suggesting that bones are good indicators of uranium exposed via ingestion of drinking water. Therefore, such studies trigger further assessment of uranium's adverse health effects on humans and/or the environment for countries where elevated uranium concentration in drinking water has been observed. Hence, it becomes important to study the level of uranium in drinking water for health risk assessment.

Uranium concentration in the shallow ground water varies primarily due to recharge and discharge, which would have dissolved or leached the uranium from the weathered soil to groundwater zone. High uranium concentrations observed in groundwater may be due to local geology, anthropogenic activities, urbanization and use of phosphate fertilizers in huge quantity for agriculture purpose. Studies have shown that phosphate fertilizer possess uranium concentration ranging from 1 mg/kg to 68.5 mg/kg (Brindha K et al., 2011). Hence, the phosphate fertilizers manufactured from phosphate rocks2may also contribute 3ura8 nium to ground water in agriculture region. In ores, uranium is found as uranite (UO^{2+}) and pitchblende ($U O^{2+}$) or in the form of secondary minerals (complex oxides, silicates, phosphates, vanadates).

Table 16 : Summary of uranium concentrations in different types of rocks

Rocks	Range(mg/kg)
Granite	3.4
Limestone/dolomite	2.2
Argillaceous shale	3.7
Sediments	1.4-53
Phosphates	30-100

Table 16 A Standards and guidelines for uranium in drinking water in various countries*.

Sl. No	Country / agency	guideline value (µg/L)	Reference
1	Australia	GV 17	NHMRC, Australia (2011)
2	Bulgaria	ML 60	European Food Safety Authority (2009)
3	Canada	MAC 20	Health Canada (2019)
4	Finland	RV 100	European Food Safety Authority (2009)
5	India	RBL 60	AERB, India (2004)
6	India	PL 30	BIS,2012
7	Malaysia	MAV 2	Ministry of Health Malaysia (2004)
8	USA	MCL 30	USEPA (2011)
9	WHO	PGV 30	WHO 2011

**GV, Guideline value; ML, Maximum limit; MAC, Most acceptable concentration; RV, Recommended value; RBL, Radiological based limit; PL, Permissible Limit; MAV, Maximum acceptable value; MCL, Maximum contaminant level; PGV, Provisional guideline value*

Distribution of Uranium (U)

To assess the Uranium concentration and distribution in the ground water, Central Ground Water Board, Western Region, Jaipur (RAJ). had decided to carry out Uranium sampling of its National Hydrograph Network Stations (NHNS) in the entire state during Pre-monsoon monitoring (May,2023) for Total 630 number of samples. The sample collection and storage were done according to the standard protocols prescribed by APHA (2017). The groundwater samples were collected in plastic bottles without acidification. Uranium (U) was detected using fluorimeter . To ensure quality control, standard checks were performed on every ten samples. Out of 630 samples where Uranium concentration above 0.030 mg/l is observed in 21 districts out of 33 districts of Rajasthan state ((21.27%) .Most of locations in 10 districts

where more than four locations where >30 ppb uranium were found namely Jodhpur , Jaipur, Nagaur, Tonk, Bikaner, Bharatpur, Ganganagar, Churu & remaining 11 districts having one to three locations where more than 30 ppb uranium were found namely Alwar, , Dausa, Hanumangarh, Jaisalmer, Jalore, Jhunjhunu, Karauli, Rajshamand, Swai Madhopur, Sikar and Bhilwara .One value of uranium 1.035 mg/l is exception one value at Guda Rayka in Jodhpur district. Other high value 0.600 mg/l of uranium is found at Deoli in Tobk district. The uranium content in ground water ranges from BDL to 0.600 mg/L. BIS recommends that uranium concentration up to 0.03 mg/L in drinking water is acceptable. Classification of samples based on this recommendation, it is found that 21.27 % samples have uranium above 0.03 mg/L. Plate-19 showing spatial distribution of uranium content in ground water (2023) indicates that ground waters with uranium above 0.03 mg/l are found mainly in 21 district in the state . Alwar , Barmer, Bharatpur, Bhilwara, Bikaner, Churu, Dausa, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Karauli, Nagaur, Pali, Rajsamand, Sawaimadhopur, Sikar, and Tonk. Periodic variation from 2020 to 2023 , the value of uranium location are 8.21 %.

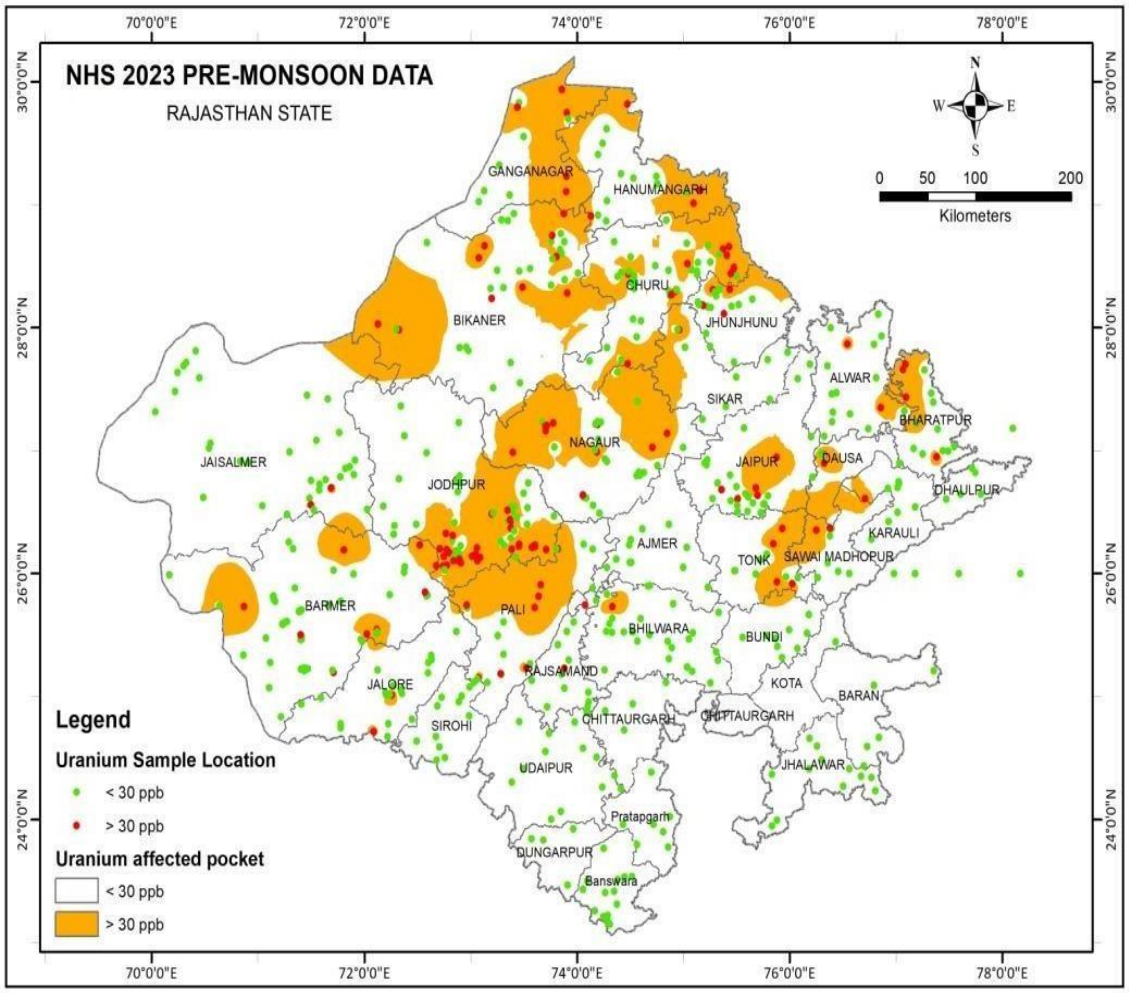


Plate-19 : Distribution of Uranium in 2023

The Table 16 B given below provides for the number of samples analyzed per district, along with their minimum, maximum, and mean Uranium values based on NHS 2023 Data.

Table 16B: District wise Range and distribution of Uranium in shallow GW of Rajasthan

	district	No.of samples analysed	Permissible limit (30 ppb)	Min	Max.	Mean	< 30ppb	> 30ppb
1	AJMER	14	30	3.80	20	11.74	100.00	0.00
2	ALWAR	15	30	1.00	36	13.44	86.67	13.33
3	BANSWARA	14	30	0.00	10	4.29	100.00	0.00
4	BARAN	5	30	0.00	5	2.00	100.00	0.00
5	BARMER	54	30	0.39	140	20.94	83.64	16.36
6	BHARATPUR	18	30	0.06	135	28.08	72.22	27.78
7	BHILWARA	27	30	0.00	120	13.22	96.30	3.70
8	BIKANER	37	30	2.40	166	31.52	72.22	27.78
9	BUNDI	9	30	0.00	29	8.56	100.00	0.00
10	CHITTAURGARH	5	30	3.90	28	11.52	100.00	0.00
11	CHURU	44	30	0.80	551	44.38	75.00	25.00
12	DAUSA	10	30	0.72	86	23.83	70.00	30.00
13	DHAULPUR	6	30	0.37	15	6.23	100.00	0.00
14	DUNGARPUR	4	30	2.00	6	3.75	100.00	0.00
15	GANGANAGAR	11	30	0.00	220	46.19	54.55	45.45
16	HANUMANGARH	16	30	0.00	494	57.25	75.00	25.00
17	JAIPUR	32	30	0.00	150	18.67	84.38	15.63
18	JAISALMER	33	30	0.00	50	12.97	93.94	6.06
19	JALORE	23	30	0.00	75	16.85	82.61	17.39
20	JHALAWAR	12	30	0.00	9	1.42	100.00	0.00
21	JHUNJHUNU	19	30	2.00	80	23.53	78.95	21.05
22	JODHPUR	72	30	1.05	1035	54.68	54.17	45.83
23	KARAULI	11	30	3.10	86	21.77	81.82	18.18
24	KOTA	1	30	9.00	9	9.00	100.00	0.00
25	NAGAUR	39	30	2.00	126	24.90	71.79	28.21
26	PALI	19	30	0.55	100	43.06	42.11	57.89
27	PRATAPGARH	7	30	0.00	5	2.14	100.00	0.00
28	RAJSAMAND	15	30	0.00	33	13.99	86.67	13.33
29	SAWAI MADHOPUR	11	30	0.00	75	22.18	72.73	27.27
30	SIKAR	8	30	6.38	64	24.76	87.50	12.50
31	SIROHI	13	30	0.00	26	11.55	100.00	0.00
32	TONK	14	30	0.00	600	84.93	57.14	42.86
33	UDAIPUR	12	30	0.00	20	4.69	100.00	0.00
		630						

Temporal variation of uranium in ground water during the period from 2020 TO 2023, It has been observed (Table 18) that total number of districts affected by high Uranium has increased **from 84 in** 2020 **to 134 in** 2023. Trend of uranim in Rajasthanis given below in plate-20

Table 16C: Comparative Change in number of Locations having U>30ppb

S.No.	District	No. of locations having Uranium > 30 ppb			
		2020	2021	2022	2023
1	AJMER	7	6	0	0
2	ALWAR	0	0	1	2
3	BANSWARA	0	0	1	0
4	BARAN	0	0	1	0
5	BARMER	10	2	3	9
6	BHARATPUR	1	0	7	5
7	BHILWARA	3	2	4	1
8	BIKANER	3	3	8	10
9	BUNDI	1	1	0	0
10	CHITTAURGARH	1	7	0	0
11	CHURU	3	3	6	11
12	DAUSA	0	0	4	3
13	DHAULPUR	1	2	0	0
14	DUNGARPUR	0	0	0	0
15	GANGANAGAR	3	2	7	5
16	HANUMANGARH	3	2	3	4
17	JAIPUR	12	10	9	5
18	JAISALMER	1	1	0	2
19	JALORE	1	1	1	4
20	JHALAWAR	0	0	0	0
21	JHUNJHUNU	1	3	5	4
22	JODHPUR	10	4	17	33
23	KARAULI	1	1	3	2
24	KOTA	0	0	0	0
25	NAGAUR	5	2	9	11
26	PALI	5	3	2	11
27	PRATAPGARH	0	2	0	0
28	RAJSAMAND	5	4	3	2
29	S. MADHOPUR	2	1	3	3
30	SIKAR	0	6	3	1
31	SIROHI	1	1	1	0
32	TONK	4	3	9	6
33	UDAIPUR	0	0	1	0
	TOTAL	84	72	111	134

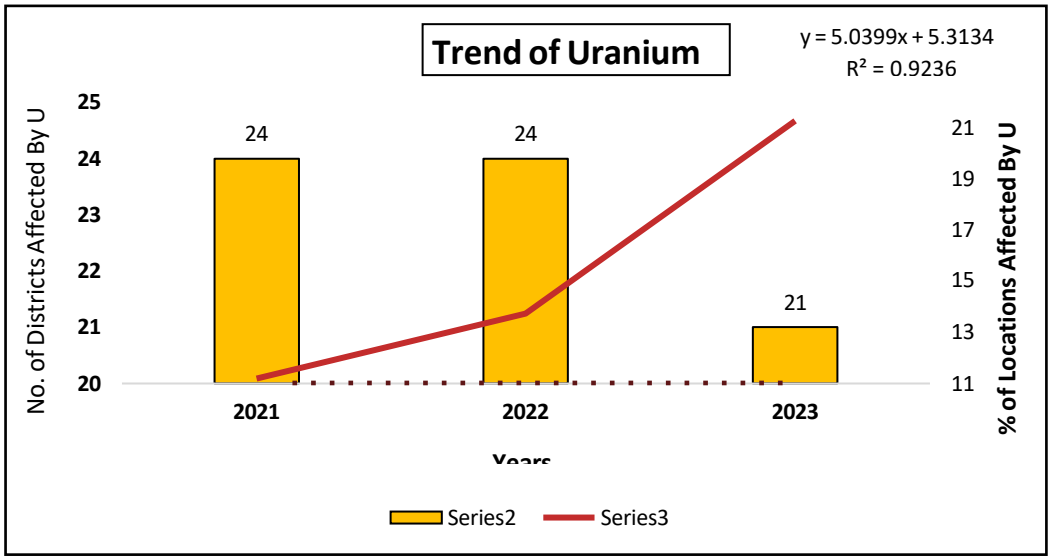


Plate-20 : Trend of uranim in Rajasthan

Table :16D :Periodic variation in suitability Classes of Fluoride in groundwater of Rajasthan

Parameter	Class	Pecentage of samples				Periodic variation
		2020	2021	2022	2023	PERIODIC Variation 2020-2023
		n=(640)	n=(774)	n=(809)	n=(630)	
Uranium	< 30ppb	86.94	88.81	86.28	78.73	08.21
	>30ppb	13.06	11.19	13.72	21.27	-08.21

Table -16E : Percent of locctions and Number of districts Uranium affected since 2020-2023

No. of districts	year	No. of districts	% of locations affected by U
23	2020	*23*	*13.06*
24	2021	*24*	*11.19*
24	2022	*24*	*13.72*
21	2023	*21*	21.27

REMEDIAL MEASURES

Finding a remedy for the uranium contaminated groundwater effectively and thoroughly, has become need of day. Remediation technologies can be classified into physical, chemical and biological methods. Bioremediation is divided into plant and microorganism methods. Each method consists of both advantages and disadvantages and the appropriate mitigation techniques should be need based.

Adsorption has a high removal efficiency, but costs are also higher. The coagulation process is simple and comparatively economical, but the standard effluent concentration is hard to reach, so there is a need for follow-up treatment. Combined with adsorption, coagulation can remove 99% of U. The extraction process can remove effluent U concentrations of less than 0.05mg / L, but it will produce a lot of sludge. Reverse osmosis is referred as a best technology, but due to its high cost it can not be used on community scale. The evaporation method is simple and effective, the removal rate is high, but there are high costs and sludge needs that must be dealt with. A review of various treatment technologies for Uranium removal from water and their technical achievability as reported by various researchers are given below in Table 16F

16F : Comparison of treatment methods for removal of Uranium.

Treatment Method	**Technical Achievability (%)**
Coagulation/filtration at high pH (10+)	> 95
Lime softening	85-99
Anion exchange	99
Reverse osmosis	>95
Activated alumina	90
Coagulation/filtration	80-89

(Source: Hand Book for Drinking Water Treatment, JJM, Ministry of Jal Shakti, Gov. of India).

Types of water Piper plot :

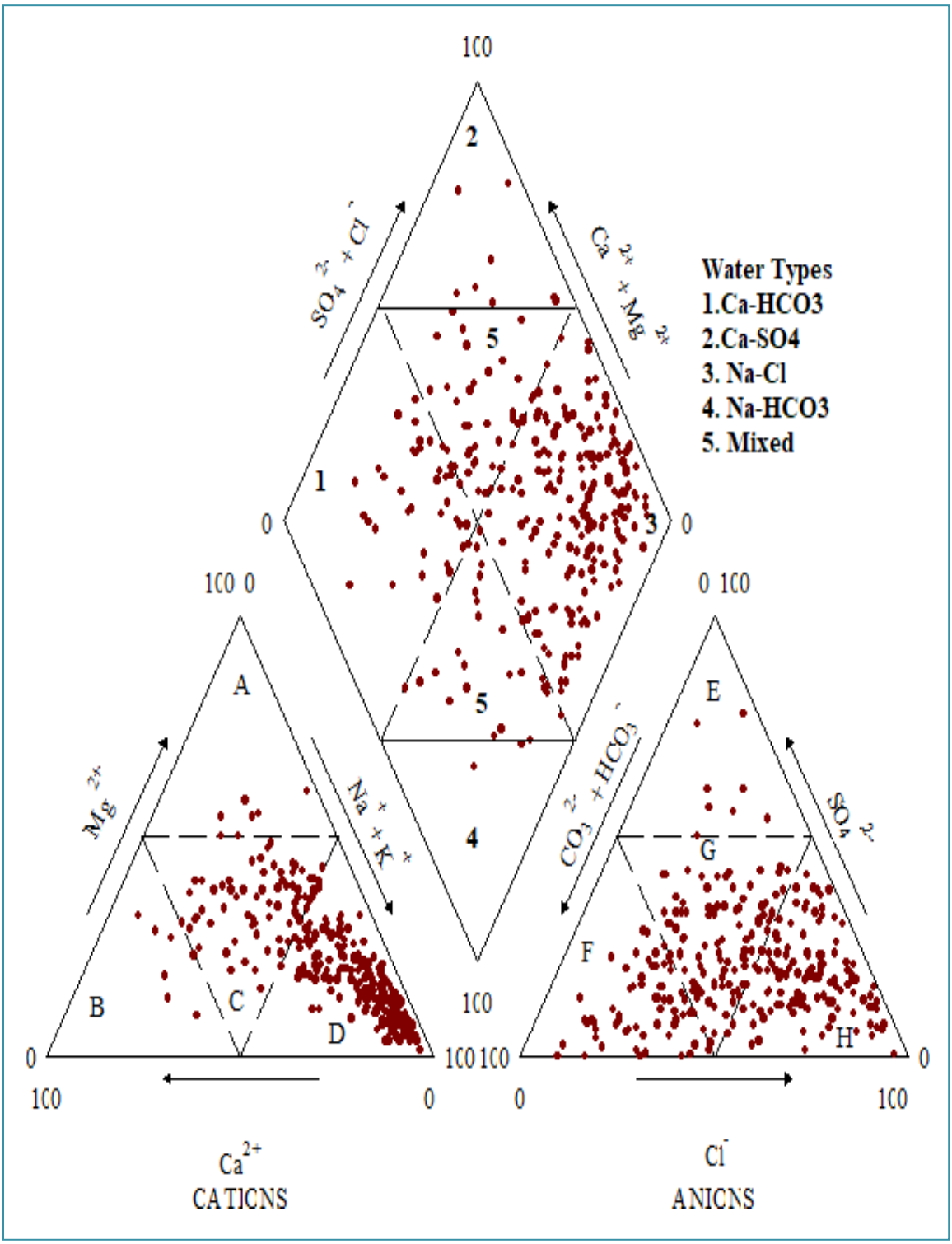


Plate- 21A : Piper Plot

To understand the ground water evolution of State of Rajasthan, out of total 33 districts two Piper diagrams 21 A & 21 B was created for the 16 districts namely Ajmer, Alwar, Banswara, Baran, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chhiorgarh, Churu, Dhaulpur, Dausa, Dungarpur, Ganganagar and Hanumangarh and for 17 districts(PLATE 21B) Jaipur, Jaisalmer, Jhalawar, Jalor, Jhunjhunu, Jodhpur, Karuli, Kota, Nagaur, Pali, Pratapgarh, Rajsamand, Sawaimadhopur, Sikar, Sirohi, Tonk and Udaipur using the analytical data obtained from the hydrochemical analysis. In general, we can classify the sample points in the piper diagram into 5 fields. They are 1. Ca-HCO_3 type, 2. Ca-Mg- Cl type, 3. Na-Cl type, 4. Na-HCO_3 type and 5. Mixed type.

In Piper diagram comprising the 16 districts that covers the northern and eastern and some central part of Rajasthan state, majority of the samples (62%) are plotted in the Na-Cl field and 25 % of the samples showed Ca-HCO_3 type. Rest of them was fall in the Ca-SO_4 and Mixed water types. Only few samples fall in fresh category that is Na-HCO_3 type. Evaluation of the water types using piper plot suggests that there is a clear indication that water quality is somewhat fresh, but get saturated from high salinity.Whereas, the second Piper plot that covers the western, central and some southern part of Rajasthan state, majority of samples around 75% fall in Na-Cl type and Ca-SO_4-Cl water types. Only 15% samples having fresh water quality that shown the Ca-HCO_3 water type may be due to recharge zone on southern districts that is Pratapgarh, Rajsamand and Udaipur.

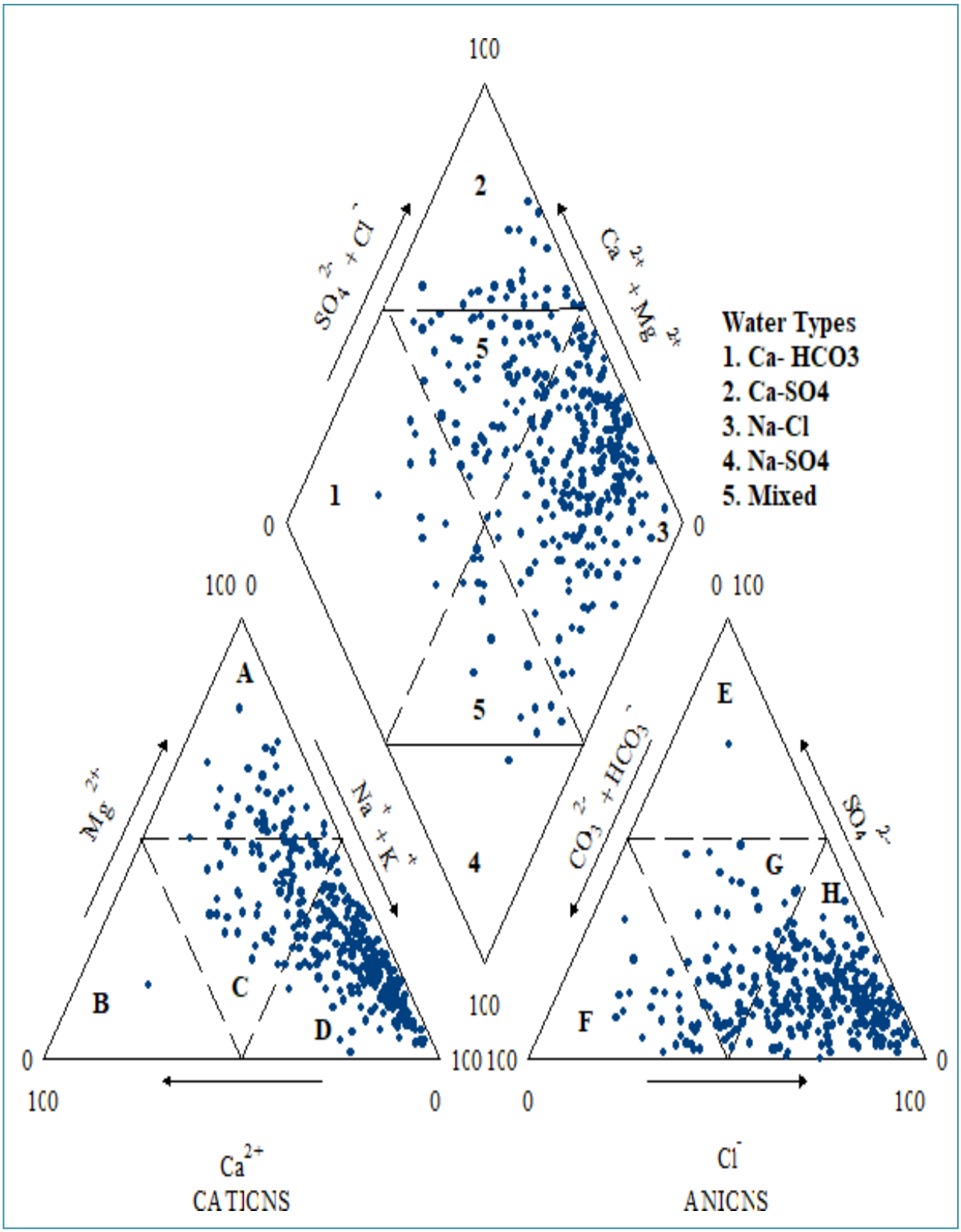


Plate 21B: Piper Plot

The calculated value of SAR in the study area ranged from 0.10 – 72.6. The maximum value of SAR (72.6) is found at Ramsar location in Barmer district. The plot of data in Plate 21C : USSL- Diagram wherein the EC is plotted against SAR, for 16 districts namely Ajmer, Alwar, Banswara, Baran, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chhiorgarh, Churu, Dhaulpur, Dausa, Dungarpur, Ganganagar and Hanumangarh diagram shows that most of the water samples fall in the category C2S1, C3S1, C3S2 and C4S3 and C4S4 indicating medium to very high salinity and sodicity. C2S1, C3S1, C3S2 and C4S2 category water is used for plants with good salt tolerance and C3S3, C4S3 Category water can also used after proper treatment. . Category C4S4 is not suitable for agriculture activity.

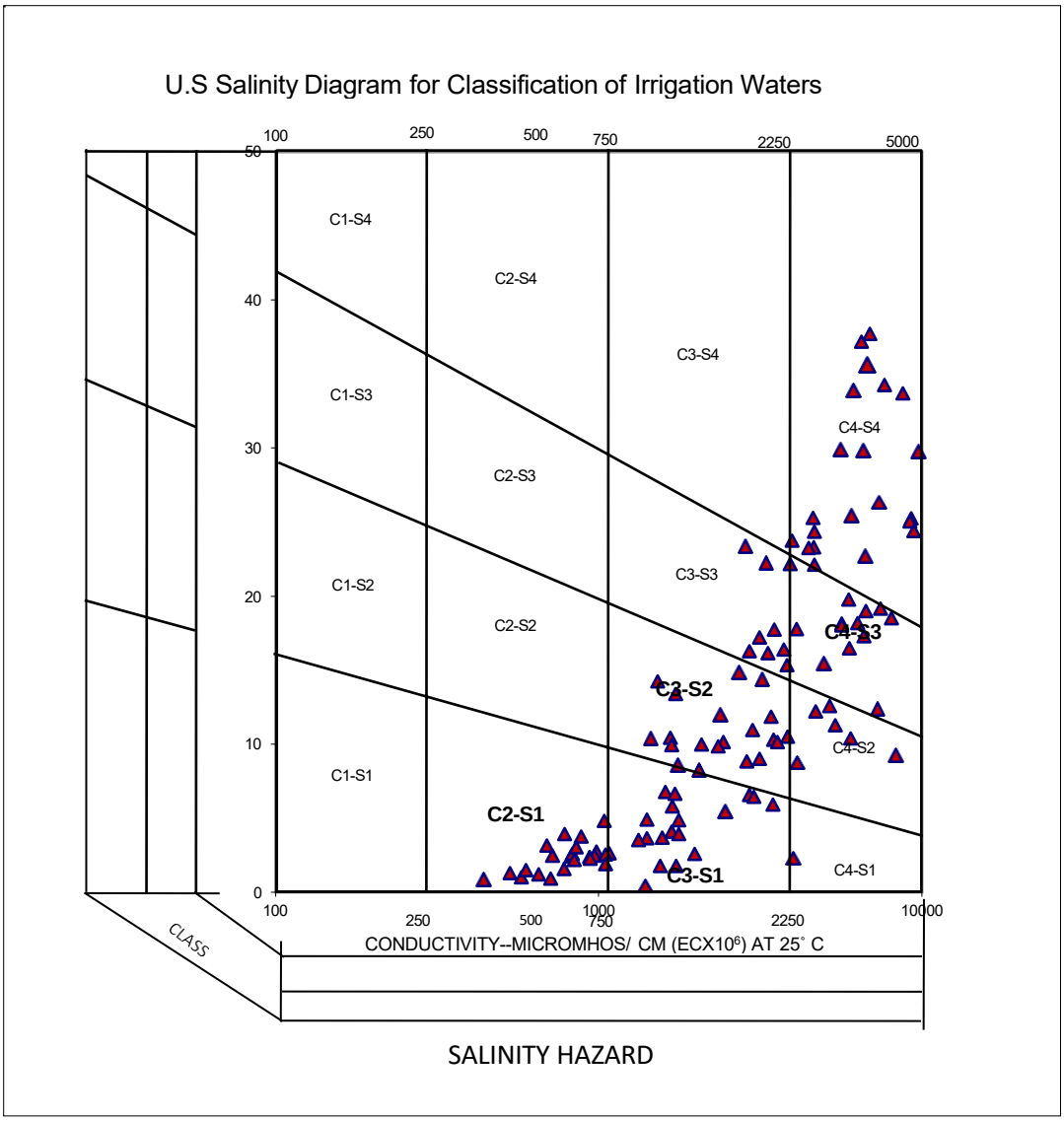


Plate 21C : USSL- Diagram -A

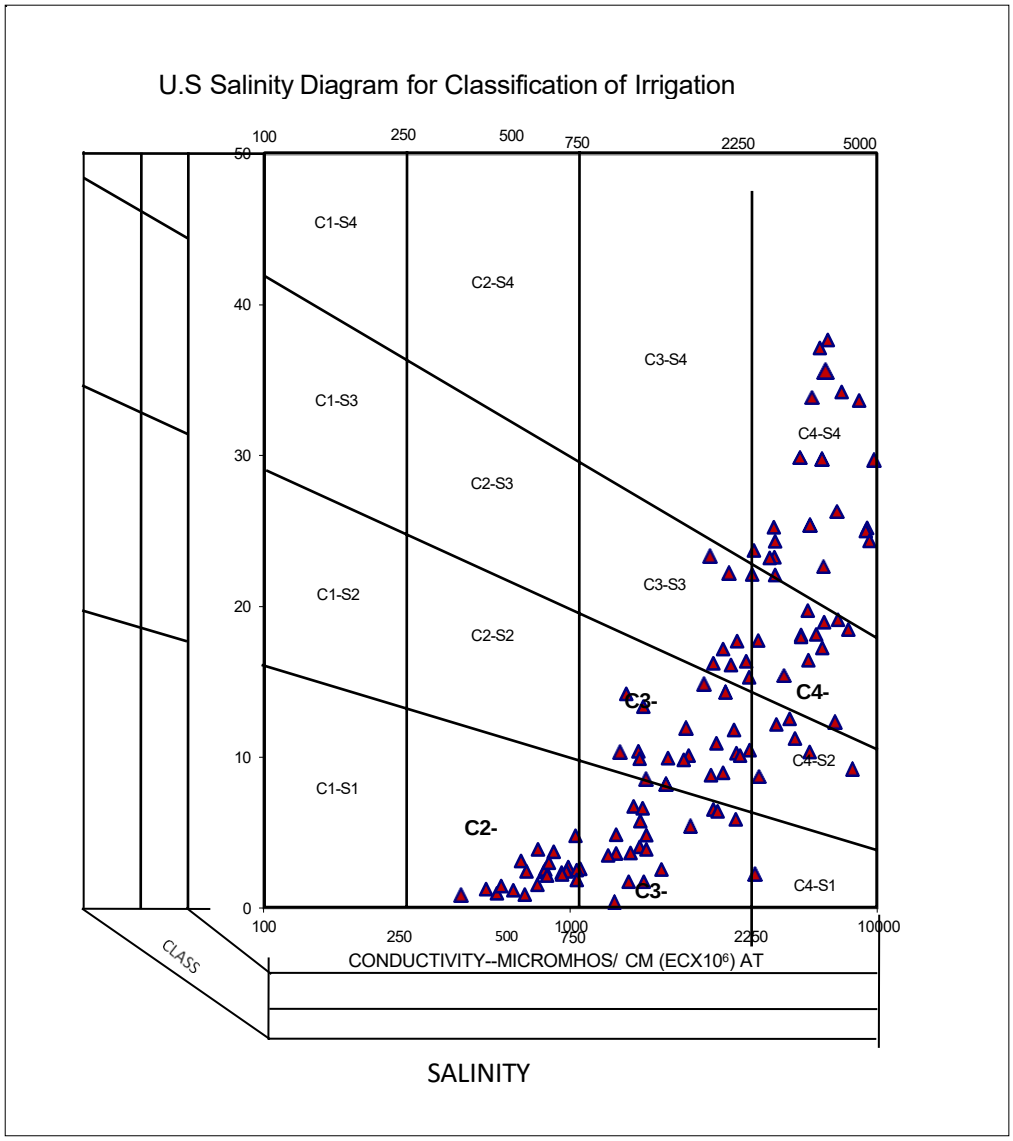


Plate 21D : USSL- Diagram -B

USSL Diagram given in Plate 21D for 17 districts Jaipur, Jaisalmer, Jhalawar, Jalor, Jhunjhunu, Jodhpur, Karuli, Kota, Nagaur, Pali, Pratapgarh, Rajsamand, Sawaimadhopur, Sikar, Sirohi, Tonk and Udaipur most of the water samples fall in the category C2S1, C3S1, C3S2 and C4S3 and C4S4 indicating medium to very high salinity and sodicity. C2S1, C3S1, C3S2 and C4S2 category water is used for plants with good salt tolerance and C3S3, C4S3 Category water can also used after proper treatment. Category C4S4 is not suitable for agriculture activity.

8.70 Potability of Ground Water:

To assess the suitability of ground water for drinking purpose, district-wise percent distribution of groundwater samples according to BIS guidelines for acceptable and permissible criteria for each constituent is tabulated in Table 6 & 7. On perusal of analysed data , it is observed that The ground water occurring beyond permissible limit 2000 mg/l of TDS in Barmer (81.48%),Nagaur (74.36%),Jodhpur (69.44%),Jaislmer(63.64%),Churu (61.36%),Bhartatpur (61.11%),Dausa (60.00%),Jalore (56.62 %),Karauli (54.55%),Jaipur (53.13%),Jhunjhunu (52.63%), Hnaumangarh and Tonk (50% each), Pali947.37%), Bhilwara (44.44%),AJMER (42.86%) & Bikaner(40.54%). Data is reveals that most of west Rajasthan and north west is having very poor water quality for drinking purposes.In 2023 trend analysis is carried out and found 48.73 % samples having TDS values is beyond permissible limit and water is not suitable for driking purposes. Periodic variation is given below show the water quality is continue detoriated from 2020 to 2023. Temporal variation of EC in ground water during the period from 2020 TO 2023. Out of 630 sample analysed, 26.51 % have chloride value beyond permissible limit of 1000 mg/l. 40.16 % between acceptable and permissible limit and water is not suitable for driking purposes and 33.33 % samples are within acceptable limit. In Nagaur (53.85 %) district, Barmer(51.85%) , Jodhpur (47.22 %), Jaisalmer (39.40%), Jalore (39.13%), & Churu (31.82 %), chloride value is beyond permissible limit. In Banswara, Bundi, Baran, Chittaurgarh Dholpur, Dungarpur,Jhalawar, Kota, Rajsamand Pratapgarh , Sikar,& Udaipur districts, none of the sample shows chloride value beyond permissible limit. Minimum value 7 mg/l is observed at at Rajpura, Churu Block,of Churu District and Maximum value of chloride (12500 mg/l) Chicharli, Luni Block, District Jodhpur. 47.14 % samples fall within acceptable limit, 24.13 % within acceptable and permissible limit and 28.7 % samples are beyond permissible limit of BIS guidelines for drinking water and these locations water is not suitable for driking purposes. In Barmer (59.26 %),Nagaur (56.41%), Dausa (40%), Hanumangarh(37.50%), Pali (36.84%) and Jodhpur 34.72% districts water samples have Sulphate value beyond permissible limit (400 mg/l). BIS permits a maximum concentration of 45 mg/L nitrate in drinking water. Considering this limit, it is found that 50.32 % of the samples, spread over the entire State, have nitrate below. 49.68 % samples having beyond the permissible limit hense water is not potable. Maximum value of nitrate 1180 mg/l has been observed at Shawa in Churu district. Pratapgarh district 85.71 % , Barmer 66.67% Churu and Karauli 63.64 % each , Baran and chittaurgarh 60.0 % each , Banswara and Tonk 57.14 % each , Jodhpur 56.94% , Hanumangarh and Jaipur 56.25%

each , Sikar and Udaipur 50% each Nagaur 48.72%, Bhilawara 48.15%, Jalore 47.83% Pali 47.37% Ganganagar and Sawaimadhopur 45.45% each , Ajmer 42.86% and Alwar 40% having more than permissible limit nitrate value.

38.73 % samples have fluoride in desirable range, 17.62 % in the permissible and the remaining 43.65 % have fluoride above 1.50 mg/L and 43.65 % locations water is not suitable for driking purposes .Map showing spatial distribution (Figure 7) of fluoride contents in ground water indicates that ground waters with fluoride above 1.50 mg/L are found mainly in Pali 73.68 %, Jalore 69.57%, Nagaur 66.67% jhunjhunu 63.16% , Sirohi 61.54 % , Jodhpur 61.11 % Jaipur 53.11 %, , Churu 47.53% , Jaisalmer 45.45%, Sawaimadhop[ur 45.45% and ajmer and Banswara 42.86 % each Barmer 42.59 % and Chittorgarh 40% districts of the State. Minimum value of fluoride has been observed 0.01 mg/l at Angai in Daulpur district & highest values of fluoride (18.50 mg/l) have been observed at Birdhwal Ganganagr,17.20 mg/l at Manj form house in Jodhpur district ,17.10 mg/l at Sujangarh in Churu district and 17.0 mg/l Nandiya in Jodhpur district in the state. There is no sample was found beyond the permissible limit in Baran and Kota It is worth mentioning that high fluoride waters are encountered in areas where high salinity is encountered.

Out of 630 samples analysed, 17.40 % samples are within Acceptable limit of 200 mg/ l for total hardness. 26.80 % samples have concentration beyond permissible limit while 56.03 % samples fall within acceptable and permissible limits. Total hardness above 600 mg/l is found in Hanumangarg (43.75%), Nagaur (43.59%), Bharatpur (40.00%), Churu(38.64%), Bhilwara (37.04%), Gaanganagar, (36.36 %), Jodhpur (30.56%),Jalore (30.43%), districts have Total Hardness concentration beyond permissible limit.

There is no cause of concern about the calcium hazard as only 6.66 % samples are beyond the permissible limit of 200 mg/l, 27.78 % samples are lies between acceptable & permissible limits of BIS. and 65.556 % samples are within acceptable limit of BIS.

Out of 630 samples where Uranium concentration above 0.030 mg/l (Acceptable limit of BIS) is observed in 21 districts out of 33 districts of Rajasthan state (21.27 % samples have uranium above 0.03 mg/L).

8.71 SUITABILITY FOR DRINKING USE (GROUND WATER QUALITY INDEX)

Water Quality Index(WQI) provides a single number that expresses the overall water quality at a certain location and time, based on several water quality parameters. The objective of WQI is to turn complex water quality data into information that is understandable and usable by the public.

A number of indices have been developed to summarize water quality data in an easily expressible and easily understood format. The WQI is basically a mathematical means of calculating a single value from multiple test results. The WQI is based on the measurement of different water Quality parameters. Thus, providing a mechanism for presenting a cumulatively derived numerical expression for defining water Quality.

The method follows three steps mainly:

1. Selection of parameters.
2. Determination of quality function for each parameter
3. Aggregation through mathematical equation.

The WQI is calculated by averaging the individual index values of some or all of the parameters within quality parameter categories that depicts the pollution level or status of the water.

The weighted arithmetic WQI method (Yisa J, Jimoh T.) was applied to assess water suitability for drinking purposes. In this method, water quality rating scale, relative weight, and overall WQI were calculated by the following formulae:

$$q_i=(C_i/S_i)\times 100 q_i$$

where q_i, C_i, and S_i indicated quality rating scale, concentration of i parameter, and standard value of i parameter, respectiv

$$w_i=1/S_i,$$

Relative weight was calculated by :

where the standard value of the i parameter is inversely proportional to the relative weight.Finally, overall WQI was calculated according to the following expression:

$$\mathbf{WQI=\sum qiwi/\sum wi}$$

The Ground water quality index value for drinking and Domestic use is calculated for each sample (Annexure VII). It has been observed that 51.43 % samples belong to the Class I & II category, representative that the water is of good to excellent cquality. While it can also be inferred that about 7.14 % water samples were unsuitable for drinking purpose.

Table 17: Groundwater quality Index value for drinking and Domestic use .

WQI range and water type:	Indication	Class	No. Of samples	% of samples
< 50	Excellent water;	I	105	16.67
50- 100	Good water;	II	219	34.76
101- 200	Poor water;	III	206	32.7
201– 300	Very poor water;	IV	55	8.73
> 300	Water unsuitable for drinking.	V	45	7.14

8.72 Scope for Irrigation

The suitability of ground water for irrigation is assessed based on EC, SAR and RSC values of waters. The diagram, suggested by USSL staff by taking EC and SAR into consideration is widely used for determining the irrigational classes of water.

The distribution of ground waters in various Eaton's index and irrigation rating based on USSL classification is given in below table.

SUITABILITY OF GROUNDWATER FOR IRRIGATION PURPOSE

The chemical quality of water is an important factor to be considered in evaluating its usefulness for irrigation purposes. Plants grown by irrigation absorb and transpire water but leave nearly all the salts behind in the soil, where they accumulate and eventually prevent plant growth. Excessive concentrations of solute interfere with the osmotic process by which plant root membranes are able to assimilate water and nutrients. In areas where natural drainage is inadequate, the irrigation water infiltrating the root zone will cause water table to rise excessively. In addition to problems caused by excessive concentration of dissolved

solids, certain constituents in irrigation water are especially undesirable and some may be damaging even when present in small concentrations. Irrigation indices viz. Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) have been evaluated to assess the suitability of ground water for irrigation purposes.

The suitability of irrigation water is mainly depending on the amounts and type of salts present in water. The productivity of irrigation has been hampered by high amounts of soluble ions in irrigation water; this water affects crop and soil fertility. The biochemical effects disturb crop metabolism. The main soluble constituents are calcium, magnesium, sodium as cations and chloride, sulphate, biocarbonate as anions. The other ions are present in minute quantities are boron, selenium, molybdenum and fluorine which are harmful to animals fed on plants grown with excess concentration of these ions. The important parameters that affect the suitability of water for irrigation, which can be utilized to verify the suitability, are explained below. The calculation of various Indices is given below-

8.72.1 Salinity Index

Based on the analysis, the groundwater samples have been classified and are given in table below.

TABLE 17 A : **CLASSIFICATION OF WATERS BASED ON OF EC.**

EC	0-250	251 - 750	751-2250	2251-5000	>5000
Salinity	Low	Medium	High	Very high	Extensively high
No of samples	2	43	206	221	158
% of samples	0.31	6.82	32.70	35.08	25.09

It is found that most of the samples (60.17 %) collected during GWM 2023-24 are categorized under high salinity to extensively high classes.

8.72.2 Percent Na:

The Wilcox (1995) and Richards (1954) have been used to categorize and recognize the elementary properties of the chemical composition of groundwater, since the mineral properties of water that effects plants and soil are measured by the suitability groundwater for irrigation. Percent sodium can be determined using the following formula:

$$\%Na = \left(\frac{Na^{+} + K^{+}}{\left(Ca^{2+} + Mg^{2+} + Na^{+} + K^{+}\right)} \right) * 100$$

where the quantities of Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} are expressed in equivalents per million.

The classification of groundwater samples with respect to percent sodium is given below and it was found that majority samples (37.45%) fall under Good category while 28.41% samples were found to be unsuitable for irrigation.

TABLE 17B : **SHALLOW AQUIFER GROUNDWATER CLASSIFICATION BASED ON PERCENT SODIUM.**

Sodium (%)	Water class	No of samples	Range (% samples)
<20	**Excellent**	**19**	3.01
20 - 40	**Good**	**79**	12.54
41 - 60	**Permissible**	**138**	21.90
61 - 80	**Doubtful**	**215**	34.13
>80	**Unsuitable**	**179**	28.41

8.72.3 Alkali Hazard

In the irrigation water, it is characterized by absolute and relative concentrations of cations. If the sodium concentrations are high, the alkali hazard is high and if the calcium & magnesium levels are high, this hazard is low. The alkali soils are formed by the accumulation of exchangeable sodium and are characterized by poor tilt and low permeability. The U.S. Salinity laboratory has recommended the use of sodium adsorption ratio (SAR) as it is closely related to adsorption of sodium by the soil.

SAR is derived by the following equation: $SAR = Na^{+} / [(Ca^{2+} + Mg^{2+})/2]^{0.5}$

The water with regard to SAR is classified into four categories

- **S1 – Low Sodium Water** (SAR <10) - Such waters can be used on practically all kinds of soils
- without any risk or increase in exchangeable sodium.
- **S2 – Medium Sodium Water** (SAR 10-18)

Such waters may produce an appreciable sodium hazard in fine textured soil having high cation exchange capacity under low leaching.

- **S3 – High Sodium Water** (SAR >18-26)

Such waters indicate harmful concentrations of exchangeable sodium in most of the soil and would require special management, good drainage, high leaching and additionof organic matter to the soil. If such waters are used on gypsiferrous soils the exchangeable sodium could not produce harmful effects.

- **S4 – Very High Sodium Waters** (SAR >26)

Generally, such waters are unsatisfactory for irrigation purposes except at low or perhaps at medium salinity where the solution of calcium from the soil or addition of gypsum or other amendments makes the use of such waters feasible.Generally, such waters are unsatisfactory for irrigation purposes except at low or perhaps at medium salinity where the solution of calcium from the soil or addition of gypsum or other amendments makes the use of such waters feasible.

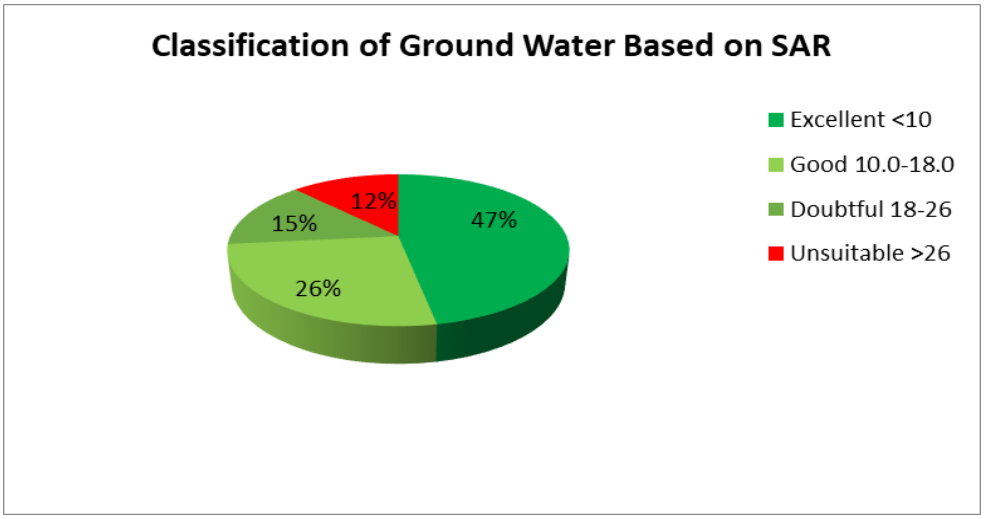


Plate-22 : Percentage of groundwater samples (Pre-Monsoon 2023) according to SAR

Sodium Absorption Ratio (SAR): SAR values is varies to excellent to good type of water for agriculture in study area and much better quality in post monsoon season. Most of water or more than 73.40% sample location is suitable for agriculture activity 14.40 % locations water is used after proper treatment. Only 12.20 % locations water is not suitable for agriculture activities.

Table17C : Clas**sification of Ground Water Based on SAR** (Source-IS : 11624-1986 Reaffirmed 2009) in pre monsoon season.

Type of Water	**Sodium Adsorption Ratio**			**Classification of Water**
	Range	**No of Samples**	**% of Samples**	
Low Sodium Water	<10	296	47.10	Excellent
Medium Sodium Water	10-18	166	26.30	Good
High Sodium Water	18-26	91	14.40	Doubtful
Very High Sodium Water	>26	77	12.20	Unsuitable

8.72.4 Residual Sodium Carbonate (RSC):

If the enriched carbonate (residual) concentration becomes relatively high, carbonates get together with calcium and magnesium to form precipitates. The relative abundance of sodium in comparison to alkaline earths and the quantity of bicarbonate and carbonate in excess of alkaline earths also influences the suitability of water for irrigation. This excess is represented in terms of "Residual Sodium Carbonate" (RSC). The highly soluble sodium carbonate known as residual sodium carbonate (RSC) is defined as;

$$\mathbf{RSC} = (\mathbf{HCO3} + \mathbf{CO3}) - (\mathbf{Ca} + \mathbf{Mg})$$

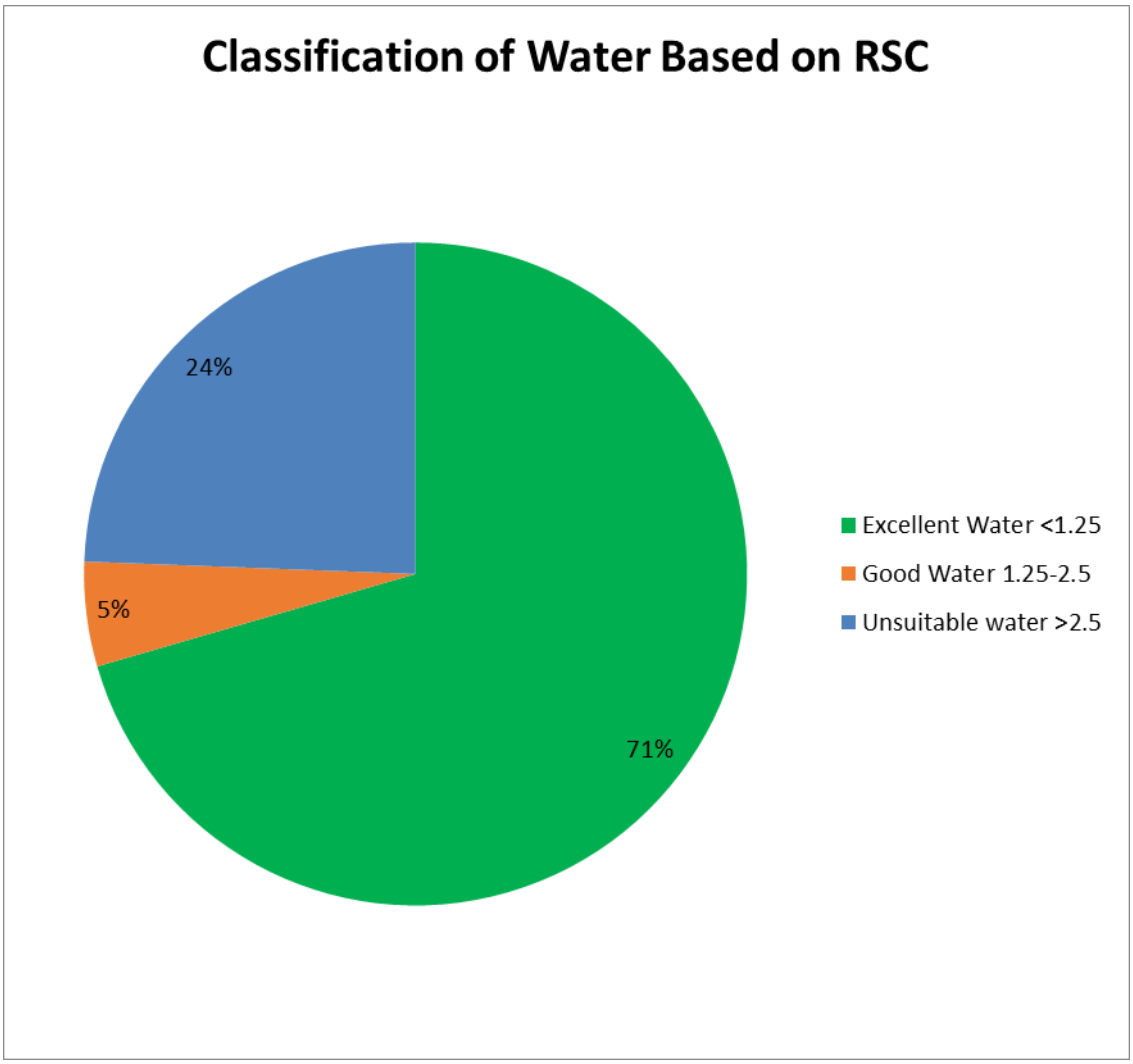


Plate-23 : Percentage of groundwater samples in various categories according to RSC classifications in Rajasthan

Waters with high RSC produces harmful effects on plant development and is not suitable for irrigation. Waters associated with RSC < 1.25 are of excellent irrigation quality and can be safely applied for irrigation for almost all crops without the risks associated with residual sodium carbonate (Wilcox et al.,1954). If the RSC values lie between 1.25 and 2.5, the water is of an acceptable quality for irrigation. Waters associated with RSC values higher than 2.5 are not acceptable for irrigation. In fig. it can be seen that in Rajasthan 70.50% collected water samples are associated with RSC values less than 1.25 and are safe for use in irrigation practices. Only 24.40% water samples are associated with RSC values more than 2.5 and are unsuitable for irrigation. The water with high RSC values if applied for irrigation

causes soil to become infertile owing to deposition of sodium. Table summarizes the irrigation quality of the groundwater samples in various districts based on RSC values. Most of water or more than 70.50% sample location is suitable for agriculture activity and 5.10 % locations water is also suitable after proper treatment.

Table 17D: Classification of Water Based on RSC in pre monsoon season

(Source-IS : 11624-1986 Reaffirmed 2009)

Type of Water	**Range**	**No. of Samples**	**% of Samples**
Excellent Water	**<1.25**	444	70.5
Good Water	**1.25-2.5**	32	5.1
Unsuitable water	**>2.5**	157	24.4

Table 17E , District wise Irrigation Rating of Well Waters of Rajasthan-2023-24 (A)

S. No.	DISTRICT	Samples analysed	IRRIGATION SUITABILITY						
			SAR				EATON's INDEX (RSC in meq/l)		
			Excellent	Good	Doubtfull	Unsuitable	Safe	Marginal	Unsafe
			0-10	10-18	18-26	>26	0-1.25	1.25-2.5	>2.5
1	AJMER	14	9	3	1	1	9	1	4
2	ALWAR	15	12	3	0	0	10	1	4
3	BANSWARA	14	14	0	0	0	11	0	3
4	BARAN	5	5	0	0	0	5	0	0
5	BARMER	55	5	18	17	15	44	2	9
6	BHARATPUR	18	8	5	3	2	11	0	7
7	BHILWARA	27	18	9	0	0	22	2	3
8	BIKANER	36	14	12	7	3	24	1	11
9	BUNDI	9	8	1	0	0	6	1	2
10	CHITTAURGARH	5	5	0	0	0	4	1	0
11	CHURU	44	15	10	12	7	32	1	11
12	DAUSA	10	4	5	1	0	7	0	3
13	DHAULPUR	6	6	0	0	0	5	0	1
14	DUNGARPUR	4	4	0	0	0	4	0	0
15	GANGANAGAR	11	10	0	0	1	9	0	2
16	HANUMANGARH	16	12	2	1	1	11	1	4
17	JAIPUR	32	17	8	5	2	18	1	13
18	JAISALMER	33	5	19	5	4	23	1	9
19	JALORE	23	9	7	3	4	17	3	3
20	JHALAWAR	12	11	1	0	0	11	0	1
21	JHUNJHUNU	19	7	6	2	4	5	0	14
22	JODHPUR	72	13	23	15	21	48	5	19
23	KARAULI	11	7	3	0	1	8	1	2
24	KOTA	1	1	0	0	0	0	1	0
25	NAGAUR	39	8	10	13	8	28	0	11
26	PALI	19	7	7	3	2	10	2	7
27	PRATAPGARH	7	7	0	0	0	7	0	0
28	RAJSAMAND	15	15	0	0	0	12	2	1
29	SAWAI MADHOPUR	11	6	1	3	1	6	1	4
30	SIKAR	8	6	2	0	0	3	3	2
31	SIROHI	13	10	3	0	0	13	0	0
32	TONK	14	6	8	0	0	9	0	5
33	UDAIPUR	12	12	0	0	0	10	1	1
Total		630	296	166	91	77	442	32	156

Table 17F , District wise Irrigation Rating of Well Waters of Rajasthan-2023-24 (B)

S. No.	DISTRICT	Samples analysed	IRRIGATION SUITABILITY								
			SAR					EATON's INDEX (RSC in meq/l)			
			Excellent	Good	Doubtfull	Unsuitable		Safe	Marginal	Unsafe	
			0-10	10-18	18-26	>26	> 26 in %	0-1.25	1.25-2.5	>2.5	>2.5 in %
1	AJMER	14	9	3	1	1	7.14	9	1	4	28.57
2	ALWAR	15	12	3	0	0	-	10	1	4	26.67
3	BANSWARA	14	14	0	0	0	-	11	0	3	21.43
4	BARAN	5	5	0	0	0	-	5	0	0	-
5	BARMER	55	5	18	17	15	27.27	44	2	9	16.36
6	BHARATPUR	18	8	5	3	2	11.11	11	0	7	38.89
7	BHILWARA	27	18	9	0	0	-	22	2	3	11.11
8	BIKANER	36	14	12	7	3	8.33	24	1	11	30.56
9	BUNDI	9	8	1	0	0	-	6	1	2	22.22
10	CHITTAURGARH	5	5	0	0	0	-	4	1	0	-
11	CHURU	44	15	10	12	7	15.91	32	1	11	25.00
12	DAUSA	10	4	5	1	0	-	7	0	3	30.00
13	DHAULPUR	6	6	0	0	0	-	5	0	1	16.67
14	DUNGARPUR	4	4	0	0	0	-	4	0	0	-
15	GANGANAGAR	11	10	0	0	1	9.09	9	0	2	18.18
16	HANUMANGARH	16	12	2	1	1	6.25	11	1	4	25.00
17	JAIPUR	32	17	8	5	2	6.25	18	1	13	40.63
18	JAISALMER	33	5	19	5	4	12.12	23	1	9	27.27
19	JALORE	23	9	7	3	4	17.39	17	3	3	13.04
20	JHALAWAR	12	11	1	0	0	-	11	0	1	8.33
21	JHUNJHUNU	19	7	6	2	4	21.05	5	0	14	73.68
22	JODHPUR	72	13	23	15	21	29.17	48	5	19	26.39
23	KARAULI	11	7	3	0	1	9.09	8	1	2	18.18
24	KOTA	1	1	0	0	0	-	0	1	0	-
25	NAGAUR	39	8	10	13	8	20.51	28	0	11	28.21
26	PALI	19	7	7	3	2	10.53	10	2	7	36.84
27	PRATAPGARH	7	7	0	0	0	-	7	0	0	-
28	RAJSAMAND	15	15	0	0	0	-	12	2	1	6.67
29	SAWAI MADHOPUR	11	6	1	3	1	9.09	6	1	4	36.36
30	SIKAR	8	6	2	0	0	-	3	3	2	25.00
31	SIROHI	13	10	3	0	0	-	13	0	0	-
32	TONK	14	6	8	0	0	-	9	0	5	35.71
33	UDAIPUR	12	12	0	0	0	-	10	1	1	8.33
Total		**630**	**296**	**166**	**91**	**77**	**12.22**	**442**	**32**	**156**	**24.76**
% Velue			**46.98**	**26.35**	**14.44**	**12.22**	**100.00**	**70.16**	**5.079**	**24.76**	**100.00**

8.1 COMPARATIVE STUDY OF GWM 2020-21 , 2021-22, GWM 2022-23 AND GWM 2023-24

In comparison to 2020 and 2023, it is observed that there is a variation observed in values of EC, nitrate, Fluoride, TH , Chloride in 2023.

Table 18 : **Comparative study of GWM data 2020-21, 2021-22, 2022-23 and 2023-24.**

S.No.	Parameter	Samples showing higher values in 2020		Samples showing higher values in 2021		Samples showing higher values in 2022		Samples showing higher values in 2023	
		%	Locations	%	Locations	%	Locations	%	Locations
1.	EC> 3000µ S/cm	28.5	176	28.04%	195	27.5%	247	48.73	307
2.	Cl >1000 mg/l	13.28	85	11.62	90	15.70	127	26.51	167
3.	NO3 > 45 mg/l	39.54	253	35.92	278	41.53	339	49.68	313
4.	F >1.5 mg/l	27.5	176	16.92	131	26.45	214	43.65	275
5.	TH >600 mg/l	16.89	108	18.09	116	24.22	155	26.83	169

TABLE 18.A **COMPARATIVE STUDY OF GWM EC DATA 2020-21, 2021-22, 2022-23 AND 2023-24.**

	Class	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		N=640	N=774	N=809	N=630	
Salinity as EC	<750 us/cm	18.89	15.37	11.07	7.14	11.75
	750-3000	52.6	56.58	61.44	44.13	8.47
	>3000	28.5	28.04	27.5	48.73	-20.23

Table 18.B : Comparative study of GWM Chloide data 2020-21, 2021-22, 2022-23 and 2023-24

Parameter	Class (mg/l)	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		N=640	N=774	N=809	N=630	
Chloride	<250	57.34	56.20	50.93	33.33	24.01375
	250-1000	29.375	32.17	33.37	40.16	-10.785
	>1000	13.28	11.62	15.7	26.51	-13.22875

Table 18.C : Comparative study of GWM nitrate data 2020-21, 2021-22, 2022-23 and 2023-24

Parameter	Class	Percentage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
NITRATE		N=640	N=774	N=809	N=630	
	< 45 mg/l	60.46	64.08	58.47	50.32	10.14
	> 45mg/l	39.54	35.92	41.53	49.68	-10.14

Table 18D : Comparative study of GWM Fluoride data 2020-21, 2021-22, 2022-23 and 2023-24

Par ameter	Class	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		N=640	N=774	N=809	N=630	
Fluoride	< 1 mg/l	58.66	69.58	55.71	38.73	19.93
	1-1.5 mg/l	13.84	13.5	18.39	17.62	-3.78
	>1.5 mg/l	27.50	16.92	26.45	43.65	-17.37

Table 18E : Comparative study of GWM Total hardness data 2020-21, 2021-22, 2022-23 and 2023-24

Parameter	Class	Pecrntage of samples				Periodic variation
		2020	2021	2022	2023	2020-2023
		(n=640)	(n=774)	(n=809)	(n=630)	
TOTAL HARDNESS	<200 mg/l	29.06	20.8	15.95	17.14	11.92
	200-600	54.06	61.11	59.83	56.03	-1.97
	>600	16.89	18.09	24.22	26.83	-9.94

Table 18E : Table- Comparative study of GWM data 2020-21, 2021-22, 2022-23 and 2023-24.

S.No.	Parameter	Samples showing higher values in 2020		Samples showing higher values in 2021		Samples showing higher values in 2022		Samples showing higher values in 2023	
		%	Locations	%	Locations	%	Locations	%	Locations
1.	EC> 3000µ S/cm	28.5	176	28.04%	195	27.5%	247	48.73	307
2.	Cl >1000 mg/l	13.28	85	11.62	90	15.70	127	26.51	167
3.	NO3 > 45 mg/l	39.54	253	35.92	278	41.53	339	49.68	313
4.	F >1.5 mg/l	27.5	176	16.92	131	26.45	214	43.65	275
5.	TH >600 mg/l	16.89	108	18.09	116	24.22	155	26.83	169

Comparative study shows that values of Nitrate, EC,Cl , F ,NO3 and TH having increasing trend in terms of number of samples since 2020 to 2023 and also we concluded that variation trend in value of major parameter is also observed 2020 to 2022 and due to revise policy more variation was observed in major parameters values in 2023 .Compararison of Maximum values of few parameters in the entire state of Rajasthan, following are the observations:

TABLE 18F: MAXIMUM VALUES OF FEW PARAMETERS IN THE ENTIRE STATE OF RAJASTHAN OF GWM DATA 2020-21, 2021-22, 2022-23 AND 2023-24.

S.No	Parameter	Max during GWM 2020		Max during GWM 2021		Max during GWM 2022		Max during GWM 2023	
		Value	Location	Value	Location	Value	Location	Value	Location
1.	Electrical Conductivity (µS/cm)	17210	Tickel (Jaipur)	17420	Mozmabad (Jaipur)	24290	Kukunda (Jodhpur)	27200	Taranagar (Churu)
2.	Chloride (mg/l)	4382	Panchala (Barmer)	5388	Panchala (Barmer)	9359	Kukunda (Jodhpur)	12500	Chicharli (Jodhpur)
3.	Nitarte (mg/l)	1400	Sahar (Karauli)	1750	Sohela (Tonk)	1350	Karsai (Karauli)	1180	Shawa (Churu)
4.	Fluoride (mg/l)	9.65	Langriya (Ganganagar)	22.30	Arjansar (Bikaner)	15.25	Sardarshar (Churu)	18.20	Birdhwal (Ganganagr)
5.	Total Hardness (mg/l)	3575	Nasnota (Barmer)	4320	Mozmabad (Jaipur)	3600	Khariakua – (Jaisalmer)	6400	Taranagar (Churu)

In general, it is observed that the maximum values of parameters like Fluoride, EC, Chloride have showing increasing trend and slight decrease trend observed in nitrate trend in the state during 2020 to 20

8.2 DISTRICTWISE WATER QUALITY SCENARIO IN RAJASTHAN

The Water quality with respect to Basic Parameters in 33 Districts of Rajasthan has been described below.

8.2.1 Ajmer

The geographical area of the district 8,481 sq.km and is located in the central part of the Rajasthan State. The district is characterized by hill and valleys and dunal landscapes. There is no perennial river in the area but small ephemeral rivers like Khari, Saraswati, Sagarmati, Banas and Mashi drain the district. A small part of Banas river which is perennial is also present. The district experiences arid to semiarid climate having an average rainfall to 799.1 mm. Mid to normal type of drought is prevalent in the district.The principal aquifer in the district is hard rock (schist, granites and gneisses) of Bhilwara and Delhi Super Groups. The ground water is moderately alkaline in nature.

14 water samples were analysed in 2023. 42.86 % of the samples have EC values above 3000 µS/cm at 25°C with highest value observed in village Kanpura1 9740 µS/cm. Chloride concentration is higher than 1000mg/l in 14.29 % samples with highest value observed in village Kanpura1 (2162mg/l). Fluoride concentration is within acceptable limit(1.0mg/l) in 28.75% samples, 42.86% samples fall between 1.0 to 1.5 mg/l and rest of the samples fall beyond the permissible limit of 1.5mg/l. 42.86 % samples have nitrate above 45mg/l with highest value recorded in well water of Ludiyana (556 mg/l). Total hardness is above 600 mg/l in 36.8% of the area with highest value at Ramsar2(2040 mg/l). Calcium above 200 mg/l is found in only 5.3% samples while 31.6% samples have magnesium above 100mg/l.

8.2.2 Alwar :

The geographical area of the district is 8720.46 sq. km and is located in the northeastern part of the State. The district is characterized by sandy plain, isolated hill uninterrupted chain of pre- Aravalli and Delhi hill ranges and from south to north. The ephemeral Sabi, Ruparel, Chuhar, Sidh and Landoha rivers drain the district. The district experiences semiarid climate conditions having an average rainfall to 462.2 mm.Principal aquifer in the district is Quaternary alluvium, besides·it, Bhilwara and Delhi Supergroup of rocks i.e.

quartzites gneisses, schist, limestone, phyllites and post-Delhi granites also from aquifers.
15 water samples were analysed in 2023.The ground water is moderately alkaline in nature. 60 % of the samples have EC values above 3000 µS/cm at 25°C with highest value observed at Lachmangarh (8300µS/cm). Chloride concentration is higher than 1000mg/l in 6.67 % samples with highest value observed in village Lachmangarh (1843 mg/l). Fluoride and nitrate concentration is above respective permissible limit in 10.5% samples of the district with highest value recorded in well water for fluoride at Kahnawas(2.05 mg/l) and for nitrate at Mandawar 1 (148 mg/l).

8.2.3 Banswara

The geographical area of the district is 5037 sq.km and is situated in the southern most part of the State. The district is characterized by Malwa plateau of high hills with intervening valleys in the eastern part, undulating topography in the central part and plain area in the western part of the district. It is drained by perennial Mahi river. The climate of the district is sub-humid to humid type. The area has an average annual rainfall of 1280.6 mm. The main water bearing formations in the district are granites, gneisses and schist of Bhilwara Super group; phyllites, schist, quartzites of Aravalli Supergroup and Deccan Trap. The ground water is moderately alkaline in nature.
14 water samples were analysed in 2023.The ground water is with moderate alkalinity and salinity. The well water in entire district have EC values below 3000 µS/cm at 25°C with highest value observed at Ganora (1770µS/cm). Chloride concentration is also below 220 mg/l in the district. Fluoride in the area is above 1.5 mg/l in 42.86% samples with highest value observed in well water of Charakni (3.0 mg/l). 57.14 % samples have nitrate above 45mg/l with highest value recorded in well water of Samla Sahar (115 mg/l). Total hardness, Calcium and magnesium are within respective permissible limits in the district.

8.2.4 Baran

Covering an area of about 6955.31 sq. km, Baran district is situated in the south eastern part of the state. The district is characterized by the landscape of low hills and shallow plain areas and is drained by the perennial Chanble river alongwith its tributaries i.e. Kalisindh, Parwati, Parwan and Andheri. District area enjoys sub-humid climate conditions with an average annual rainfall of 1319.5 mm. Principal aquifer in the district are sandstone and limestone (Vindhyan Supergroup) besides other aquifers like Ocean basalts, shale and alluvium. The ground water is moderately alkaline in nature. 5 water samples

were analysed in 2023.The ground water is with moderately alkaline with medium salinity. All the well water in the district have EC values below the 3000 µS/cm at 25°C with highest value observed at Harnauda (1390 µS/cm). Chloride, Total hardness and magnesium are with in the respective BIS permissible limits Fluoride in the area is below 1.0 mg/l with highest value observed in well water of Bhanwargarh (1.30 mg/l). 60.0% samples have nitrate above 45mg/l with highest value recorded in well water of Chhipa barod (72 mg/l).

8.2.5 Barmer

Geographical area of the district is 28387 .00 sq. km and is located in the south western part of the state. The district is characterized by geomorphological feature of sandy plains, dunal landscape and isolated hills.The district is drained by ephemeral Luni river.The district experiences arid climate conditions having an average annual rainfall of 389.9 mm. The district often experiences mild to very severe drought. Principal aquifer in the district is Quaternary alluvium. The lathi's, Barmer sandstone, Tertiary formation and Malani Igneous Suite of rock also form aquifers at places. Potential aquifers area in the district include Bhadka area (Tertiary formation) and Undu - Kanasar area (lathiBasin). The ground water is moderately alkaline in nature.

54 water samples were analysed in 2023.The ground water is with moderately alkaline with high salinity. The well water in the district have EC values above 3000 µS/cm at 25°C in 60.6% area with highest value observed at Chawa (21760µS/cm). Chloride above 1000mg/l is observed in 51.85% of the district with 5034mg/l being the highest concentration recorded at Thob. Total hardness, Calcium and magnesium concentrations are above BIS drinking water limits in 24.32%, 5.41% and 18.92% samples, respectively. High Fluoride is observed with 42.59% of the area having concentration more than 1.5 mg/l. Fluoride of 10mg/l has been recorded in well water of village Ramsar. Similarly, 66.67% samples have nitrate above 45 mg/l with highest value recorded in well water of Thob(601 mg/l).

8.2.6 Bharatpur

Geographically area of the district is about 5044.10sq. km, and is situated towards north-eastern part of the state. Physlographlc features in the district Include isolated hills and alluvial plains in the major part.The district area is drained by Gambhir river in south,

Banganga in central and Ruparel river in northern part which are ephemeral in nature. Semiarid climatic conditions prevail in the district receiving 593.4 mm of average annual rainfall.Quaternary alluvium Is the principal aquifer whereas quartzites, slates, phyllites, gneisses (Delhi's) and Vindhyan sandstone also constitute water bearing formation at places.

18 water samples were analysed in 2023.The ground water is with moderately alkaline with high salinity. Extremely saline waters are found at Gopalgarh village with EC of 9420µS/cm and 61.11% samples have EC values above 3000 µS/cm. 27.78% of the area has chloride above 1000 mg/l with 2179 mg/l being the highest concentration recorded at Gopalgarh . Total hardness is above 600mg/l in 38.89 samples while calcium and magnesium concentrations are above respective BIS drinking water limits in 5.56% and 33.33 % samples, respectively. High Fluoride is observed with 33.33% of the area having concentration more than 1.5 mg/l. with maximum of 2.50 mg/l recorded in well water of village Nagar. 27.7% samples have nitrate above 45 mg/l with highest value recorded in well water of Mandhera (156 mg/l).

8.2.7 Bhilwara :

The district is located in central part of Rajasthan having a geographical area of 10,455 sq. Km. Bhilwara district has plain areas in the central part with a few isolated hillocks. Hill ranges are seen in north-western and eastern part of the district. The district is drained by Banas, Berach, Kothari and Khari rivers. All these rivers are ephemeral.Semiarid type of climate prevails in the district. The average annual rainfall is 966.7 mm. Mid to normal drought commonly occur in the district.Principal aquifer in the district include granites, schists,phyllites, dolomite and slates of Bhilwara, Aravalli and Delhi Super Groups. In some parts, sandstone of Vindhyan Supergroup also forms potential aquifers.

27 water samples were analysed in 2023.The ground water is with moderately alkaline with high salinity. Extremely saline waters are found at Gulabpura village with EC of 9380 µS/cm and 44.44% samples have EC values above 3000 µS/cm at 25°C. 18.52% of the area has chloride above 1000 mg/l with 2446 mg/l being the highest concentration recorded (Gulabpura). Total hardness is above 600mg/l in 37.4 samples while calcium and magnesium concentrations are above respective BIS drinking water limits in 11.11% and 33.33% samples, respectively. High Fluoride is observed with 22.22% of the area having concentration more than 1.5 mg/l. High concentration of Fluoride of 4.45mg/l has been

recorded in well water of village Mandalgarh1 48.15% samples have nitrate above 45 mg/l with highest value recorded in well water of Karoi Kotari (891 mg/l). Sodium followed by magnesium is predominant cation while no one anion is predominanting indicating base exchange exchange reaction in the groundwater. Sulphate is predominant anion in isolated places.

8.2.8 Bikaner

Occupying geographical area of 27,243 sq. km, the Bikaner district is located in the north western part of the state. The district is mainly constitutes the landscape of desertic dunal topography. No major river system exists. However, ephemeral streamlets, lakes/depression are found in the area.The district experiences arid climate conditions having an average annual rainfall of 306.8 mm. The district often suffers mild to severe drought. Tertiary sandstone forms the main aquifer in the district. Other aquifer are Quaternary Formations, Nagaur sandstone and Jodhpur sandstone.
37 water samples were analysed in 2023. The ground water is with moderately alkaline with high salinity. Highly saline waters are found at Barala Arjnsar village with EC of 14100µS/cm and 40.54 % samples have EC values above 3000 µS/cm at 25°C. 48.65 of the area has chloride above 1000 mg/l with 4538 mg/l being the highest concentration recorded (Barala). Total hardness(24%), calcium(5.41%) and magnesium(18.92) concentrations beyond their respective BIS drinking water limits in the district. High Fluoride is observed with 35.14% of the area having concentration more than 1.5 mg/l. Exceptionally high concentration of Fluoride of 15.0 mg/l has been recorded in well water of village Arjansar. 32.43% samples have nitrate above 45 mg/l with highest value recorded in well water of Garabdesar 390 mg/l.

8.2.9 Bundi

The geographical area of the district is 5550 sq. km, and is situated in south-eastern part of the state.. Population of the district as per 2001 census is 961269 persons. The district is characterized by flat, undulating topography with small isolated hills. The area is drained by perennial Chambal river and Mej river.The district experiences sub-humid type of climate.The average annual rainfall is 1198.7 mm.The principal aquifer in the area are phyllites, slates of Bhilwara Super Group, Quaternary alluvium and sandstone and limestone of Vindhyal Group.

9 water samples were analysed in 2023 the ground water is with moderately alkaline with high salinity. 11.11 % samples have EC values above 3000 µS/cm at 25°C and observed maximum EC is at Kapren village (3220 µS/cm). Total hardness and magnesium concentrations beyond their respective BIS drinking water limits are reported in 11.11% area of the district while 22.22% samples have Magnesium values above 100 mg/l. Fluoride is 3.15 at Delunda in the district while 11.11% samples have nitrate above 45 mg/l with highest value recorded in well water of Satur (129 mg/l).

8.2.10 Chittorgarh

The district is located in the south eastern part of Rajasthan. Its geographical area is 10,856 sq.km. The topography of the district in general is undulated having hills scattered all over the area. The district is drained by river Chambal and Banas. Other small rivers are Gambhir, Berach and Bamani. The area experiences sub-humid type of climate. Average annual rainfall is 1243.2 mm.

Principal aquifer in the district are gneisses, schist and Bhllwara Super Group; sandstone, shale and limestone of Vindhyan Super Group. In some parts Quaternary alluvium and Deccan basalts also form aquifer.

5 water samples were analysed in 2023. The ground water is with moderately alkaline. Salinity depicted as EC ranges upto 3300 µS/cm at Mungana and 20.0 % of the district has EC above 3000 µS/cm at 25°C. Calcium, magnesiu. Nirate, is above 45 mg/l in 60% samples with highest value recorded at Mungana (525 mg/l). fluoride is highest recorded At Purohitokasavat 1.96 mg/l.

8.2.11 Churu :

The district cover an area of 16,830.76 sq.km occupying north western part of the state. District has landscape of dunes and inter-dunes and isolated hillocks at places. The ephemeral Kantli river flows in the south eastern portion of the district. Arid climate prevails in the district' receiving average annual rainfall of 476.4 mm. Quaternary alluvium forms the main aquifer system in the district TertiarY sandstone, Nagaur sandstone, Bilara limestone, Jodhpur sandstone, granite and gneisses also fonns aquifer in the district. 44 water samples were analysed in 2023. The ground water is with moderately alkaline. Salinity depicted as EC ranges upto 27200 µS/cm at Taranagar and 61.36% of the entire district has EC above 3000 µS/cm at 25°C. 38.60% of the district area

has Total hardness and magnesium beyond respective BIS permissible limits while calcium is higher in 13.6% of samples analysed. 47.73% of well water have fluoride above 1.5 mg/l with highest value observed at Sujangarh (17.10 mg/l) while 63.64% have nitrate above 45 mg/l with highest concentration at Shawa (1180 mg/l).

8.2.12 Dausa

Geographical area of the district is 13430.17 sq. km and is situated in eastern part of the state. The district is characterized by fairly undulating plain with hi\lls. The area is drained by Banganga and Moral rivers, both are ephemeral in nature.The area experiences semiarid climate. The average annual rainfall is 739.8 mm. Mid to normal drought occurs frequently in the district. The principal aquifer in the area is Quaternary alluvium, quartzite, mica schist and granite gneiss of Delhi Super Group from the other aquifer. The depth to water level ranges from 7.97 to 56.1 mbgl. Declining water level trend has been observed in the southern part of the district. 10 water samples were analysed in 2023.The ground water is with moderately alkaline. About 36.4% samples have salinity (EC) above 3000 µS/cm at 25°C. High EC (10410µS/cm) found at jasuta and Chloride(2410 mg/l)are recorded at jasuta village. Fluoride and nitrate above respective BIS limits are found in 20.0 % of the samples. Well water in Jasuta have Fluoride concentration of 3.59 10 mg/l while Nitrate of 794 mg/l is recorded at Jasuta . Total hardness in 40 %, calcium in 10 % and magnesium in 30 % samples is above respective permissible BIS drinking water limits. Ground water of the district is generally sodic with bicarbonate and chloride predominant in anions.

8.2.13 Dhaulpur

Occupying north-eastern part of the state Dholpur district cover an area of 3009.05 sq.km. The district is characterized by landscape of hill, plateau and undulating plains. Chambal, Gambhir and Parbati rivers drain the district area.Semiarid climate conditions prevail in the district receiving an average annual rainfall of 812.2 mm. Quaternary alluvium form main aquifer whereas Vindhyan sandstone, shales and limestone also form water bearing formations in western part. 6 water samples were analysed in 2023. The ground water is with moderately alkaline with EC below 3000µS/cm in all samples. The value of Nitrate in all samples were found below permissible limits. Well water (Saipau) in Dhaulpur has Fluoride concentration of 2.82

mg/l.16.67% samples fluoride having beyond permissible limit.

8.2.14 Dungarpur

The geographical area of the district is 3770 sq. km. and it is situated in the southern part of the state. The area is characterized by hills and valleys and is drained by two perennial rivers viz. Mahi and Som. The district experiences semiarid type of climate having an average annual rainfall of 1144.3 mm. Slates, phyllites and schist of Aravalli Super Group form the principal aquifer.

4 water samples were analysed in 2023. The ground water is with moderately alkaline with medium salinity. Highest EC of 1610µS/cm is recorded at Nayadera. Most of the parameters within the permissible limits in the district . 25.0% samples having fluoride value beyond the permissible limits . Well water in Ramgarh2 has highest Fluoride concentration of 2.32 mg/l in the district.

8.2.15 Ganganagar

Geographical area of the district is 11,603.65 sq. km and it is located in the northern most part of the State. The district has landscape of alluvial plains, dunes and inter-dunes. In major part of district there is no natural drainage. Part of district Is drained by seasonal Ghaggar river. Ganga canal, Bhakra canal and Indira Gandhi Nahar have been constructed to bring Himalayan water in the district.The district experience arid climate having an average rainfall of 231.5 mm. The principal aquifer in the district is Quaternary alluvium.Tertiary sandstone also forms aquifer at places.

11 water samples were analysed in 2023. The ground water is with moderately alkaline with medium to very high salinity. Highest EC of 8450µS/cm is recorded at Jagatsinghwala.

EC found in Ahmedabad district ranges from 426 µS/cm to 8450 µS/cm with an average of 2570 µS/cm. The locations showing higher EC are Rupnagar (8450), Birdhwal(5550).The Concentration of Chloride in ground water in Ganganagar district varies between 21mg/l and 2600 mg/l .Fluoride concentration in Ganganagar district varies from 0.4 mg/l to 18.2 mg/l with an average of 3.56 mg/l. Highest value 18.2 mg/l of fluoride is found at Birdhwal.The Concentration of Nitrate in ground water in Ganganagar district varies between01.0 mg/l to 275 mg/l with an average of 93 mg/l.The location showing higher

nitrate concentration is Anupgarh (275).

8.2.16 Hanumangarh :

Covering a geographical area of 9579.54 sq. km the Hanumangarh district occupies northern part of the state. The district is characterized by diurnal landforms and aluvial plains. It is drained by ephemeral Ghaggar River. The arid climate conditions prevail in the district it receives an average annual rainfall of 352.9 mm. Quaternary alluvium forms the main aquifer system besides Tertiary sandstone in the district. 16 water samples were analysed in 2023. EC found in Hanumangarh district ranges from 316 µS/cm to 6990 µS/cm with an average of 3008µS/cm. The locations showing higher EC are Dhandhuka1(6425),Dalod(13700),Viramgam2 (6690).The Concentration of Chloride in ground water in Hanumangarh district varies between 64mg/l and 3687 mg/l with an average of 1180 mg/l. The locations showing higher chloride concentration is Panditawali (1450mg/l).Fluoride concentration in Hanumangarh district varies from 0.5mg/l to 6.4 mg/l with an average of 3.40 mg/l. Highest fluoride value 15.6 mg/l is found at Dungrana. The Concentration of Nitrate in ground water in Hanumangarh district varies between2.0 mg/l to 775 mg/l with an average of 177mg/l.The location showing higher nitrate concentration is Rawatsar (775mg/l).In this district,

8.2.17 Jaipur

Covering an area of about 11061.44 sq. km, Jaipur district is located in the eastern part of the state. The district area is characterized by wold spectrums of landscapes of sandy plains, pediments and isolated hills. It is drained by Sabi, Banganga, Sandi, mandha and Mashi and Sota river which are ephemeral in nature. The district experience semiarid climate condition having average annual rainfall of 744.2 mm. Principal aquifer in the district is Quaternary alluvium besides otherformations like quartzite, schist, phyllites and gneisses at places. The depth to water level varies from 3.68 to 86.3mbgl (2019).

32 water samples were analysed in 2023. EC found in Jaipur district ranges from 760 µS/cm to 14700 µS/cm with an average of 3690µS/cm. The locations showing higher EC are Mozmabad (14700), Nasnota (9810).The Concentration of Chloride in ground water in Jaipur district varies between 78mg/l and 4502 mg/l . The locations showing higher chloride concentration is Mozmabad (4502mg/l).Fluoride concentration in Jaipur district

varies from 0.01mg/l to 6.3 mg/l with an average of 1.97 mg/l. Highest fluoride value 6.3 mg/l is found at Sambhar. The Concentration of Nitrate in ground water in Jaipur district varies between 1.66 mg/l to 266 mg/l with an average of 80mg/l. The location showing higher nitrate concentration is Sambhar (266 mg/l).Bicarbonate and chloride are predominant anion indicating base exchange reaction. High salinity at several locations and correspondingly high concentration of several anions and cations makes the water unsuitable for domestic use.

8.2.18 Jaisalmer :

Jaisalmer district covers a geographical area of about 38401 sq. km and is situated in the western most part of the state. The district Is characterized mainly by dunal and inter-dunal landscape. There is no major drainage system in the district except small streamlets and local nalla. Arid climate prevails in the district. The district receives on an average annual rainfall of 251.8 mm.The principal aquifer in the district are quaternary alluvium and Lathi sandstone. Besides this Tertiary sandstone, rhyolites and granites also form aquifer.

EC found in Jaipur district ranges from 760 µS/cm to 12350 µS/cm with an average of 4274 µS/cm. The locations showing higher EC are Khariakua_DW (12350), Tanot (7980).The Concentration of Chloride in ground water in Jaipur district varies between 43mg/l and 4077mg/l . The locations showing higher chloride concentration is Khariakua_DW (4077mg/l).Fluoride concentration in Jaipur district varies from 0.40mg/l to 6.6 mg/l with an average of 1.65 mg/l. Highest fluoride value 6.6 mg/l is found at Janpatpura . The Concentration of Nitrate in ground water in Jaipur district varies between 1.0 mg/l to 590 mg/l with an average of 105mg/l. The location showing higher nitrate concentration is Sankara (590mg/l). Sodium is the predominant cation in most of the well water while chloride depicts predominance amongst anions. Hydrochemical facies indicate Na-Cl anion type water in the area.

8.2.19 Jalore :

Jalore district cover an area of 10640 sq. km and is located in the south western part of the state. The district is characterized by landscape of alluvial plain of hill ranges and isolated hillocks. It is drained by Jawai river which is ephemeralin nature. The district experience semiarid to arid climatic condition

having an average rainfall of 544.1 mm .The principal aquifer in the district is Quaternary alluvium besides phyllites and granites, which also form aquifer.
23 water samples were analysed in 2023. EC found in Jalore district ranges from 680µS/cm to18400 µS/cm with an average of 4096 µS/cm. The locations showing higher EC are Jalore (18400), Bagra (8600).The Concentration of Chloride in ground water in Jalore district varies between 85mg/l and 4608mg/l . The locations showing higher chloride concentration is Jalore (4608mg/l). Fluoride concentration in Jalore district varies from 0.38mg/l to 8.4 mg/l with an average of 2.99 mg/l. Highest fluoride value 8.4 mg/l is found at Bhinmal. The Concentration of Nitrate in ground water in Jalore district varies between 1.0 mg/l to 370 mg/l with an average of 83 mg/l. The location showing higher nitrate concentration is Bhagal Bhim (370mg/l). Sodium is predominant cation while chloride anions predominate, indicating sodic and saline.

8.2.20 Jhalawar

Occupying southern portion of the state, the Jhalawar district covers an area of about 6219 sq. km. Hills and Plateau are the main geomorphic features drained by, the Kali Singh in Parwan rivers of ephemeral nature. The semiarid district receives 1783.0 mm of average annual rainfall. The district is prone to mild to normal drought conditions.Deccan basalt and Vindhyal sandstone are main aquier 12 water samples were analysed in 2023. EC found in Jhalawar district ranges from 440µS/cm to1780 µS/cm with an average of 1195µS/cm. The location showing higher EC are Gagron (1780). The Concentration of Chloride in ground water in Jhalawar district varies between 35 mg/l and 291mg/l . The locations showing higher chloride concentration is Karvan kala (291mg/l). Fluoride concentration in Jhalawar district varies from 0.45mg/l to 3.50mg/l with an average of 0.94 mg/l. Highest fluoride value 3.50 mg/l is found at Karvan kala. The Concentration of Nitrate in ground water in Jhalawar district varies between 0.49 mg/l to 165 mg/l with an average of 51 mg/l. The location showing higher nitrate concentration is Saredi (165mg/l).

8.2.21 Jhunjhunu

The geographical area of the district is 5928 sq. km and it is located in the northeastern part of the state. The hilly area is south-central part. The undulatory area with small isolated hills in southwestern part. The desertic plain in the

northern part. The district is drained by ephemeral Kantli river. The area experiences arid climate having an average annual rain fall of 683.9 mm. The principal aquifer in the district are Quaternary alluvium, and weathered fractured rocks of Delhi Super Group. In general, ground water occurs under water table conditions. 19 water samples were analysed in 2023. EC found in Jhunjhunu district ranges from 582µS/cm to7560 µS/cm with an average of 3208µS/cm. The location showing higher EC are Alsisar (7560 µS/cm). The Concentration of Chloride in ground water in district varies between 57 mg/l and 1241mg/l . The locations showing higher chloride concentration is Alsisar (1241mg/l). Fluoride concentration in district varies from 0.02mg/l to 5.74mg/l with an average of 02.15 mg/l. Highest fluoride value 3.50 mg/l is found at Bhara ks bas. The Concentration of Nitrate in ground water in district varies between 1.0 mg/l to 360 mg/l with an average of 97 mg/l. The location showing higher nitrate concentration is Rampura (360mg/l). Sodium is predominant cation in most of samples while Bicarbonate and chloride are main components amongst anions.

8.2.22 Jodhpur

District covers a geographical area of about 22250 sq. km occupying western part of the state. The district is characterized by alluvium plains escarpments, hillocks and sand dunes. It is dra ined by ephemeral Luni and its tributaries. The climate of the district is arid to semiarid having an average annual rainfall of 435.7 mm. Principal aquifer is the district is Jodhpur sandstone. In addition to this granites, rhyolites, schist, slates, phyites also form aquifer. Jodhpur sandstone forms potential aquifer around Dhasar , Chand Sonki, Baran and Kapuria area.

72 water samples were analysed in 2023. EC found in Jodhpur district ranges from 250µS/cm to25000 µS/cm with an average of 6112µS/cm. The locations showing higher EC are Chicharli (25000 µS/cm). Bhandu (22500 µS/cm) The Concentration of Chloride in ground water in district varies between 35 mg/l and 1250mg/l . The locations showing higher chloride concentration is Chicharli (1250mg/l). Fluoride concentration in district varies from 0.20mg/l to 17.20 mg/l with an average of 02.15 mg/l. Highest fluoride value 17.20 mg/l, 17.00 and 15.80 are found at Manj form house, Nandiya and Guda rayka respectively. The Concentration of Nitrate in ground water in district varies between 2.0 mg/l to 880 mg/l with an average of 103mg/l. The location showing higher nitrate concentration is Bhavi (880mg/l). Sodium is predominant cation and Chloride is predominant anion in most of the well water.

8.2.23 Karauli

Geographical area of the district is 5038.60 sq. km and is located towards east-central part of the district. The area is characterized by the hills and plain areas and is drained by the rivers Gambhir, Morel and Chambal.The district experiences semi arid climatic conditions getting 583.6 mm. Both, Quaternary alluvium as well as Vindhyan sandstone constitute the aquifer systems. 11water samples were analysed in 2023.EC found in Karauli district ranges from 1200µS/cm to 7000 µS/cm with an average of 3322µS/cm. The locations showing higher EC are Sahar1 (7000 µS/cm). The Concentration of Chloride in ground water in district varies between 199 mg/l and 1602mg/l . The locations showing higher chloride concentration is Sahar1 (1602mg/l). Fluoride concentration in district varies from 0.14mg/l to 3.90 mg/l with an average of 1.04 mg/l. Highest fluoride value is 3.90 mg/l is found at Islampur. The Concentration of Nitrate in ground water in district varies between 0.21 mg/l to 398 mg/l with an average of 95mg/l. The location showing higher nitrate concentration is Hindaun (398mg/l).

8.2.24 Kota

Covering an area of 5203.94 sq. km the Kota district is located in the southeastern part of the state. The district is characterized by the landscapes of low hills and plains and is drained by the perennial Chambal and its tributaries. Semiarid climatic conditions prevail with the district receiving average annual rainfall of 1282.5 mm.Vindhyan sandstone is the Principal aquifer whereas limestone, shales (Vindhyan) as well as Quaternary alluvial deposits from aquifer at places.

1 water samples were analysed in 2023. EC found in Kota district ranges from 1920µS/cm to 1920 µS/cm with an average of 1920µS/cm. The locations showing EC is Sultanpur (1920 µS/cm). The Concentration of Chloride in ground water in district is 156 mg/l. The locations showing chloride concentration is Sultanpur (156mg/l). Fluoride concentration in district 0..64mg/l .The Concentration of Nitrate in ground water in district 14mg/l with an average of 14mg/l. The location showing higher nitrate concentration is Sultanpur (14mg/l).

8.2.25 Nagaur

Covering an area of 17718.25 sq. km the Nagaur district is situated in the

central part of the Rajasthan. The district is characterized by flat topography with small scattered hillocks in the south-eastern part and dunal landscape towards north-western and north-eastern parts. River Luni passes through the southern part of the district. The district enjoys arid to semiarid climatic conditions receiving an average annual rainfall of 652.4 mm. Drought of mild to severe nature often disturbs lives of masses. Unconsolidated Quaternary sediments form main aquifer besides sandstone, schists, gneisses and limestone etc. 39 water samples were analysed in 2023. EC found in Nagaur district ranges from 370µS/cm to20250 µS/cm with an average of 5796µS/cm. The locations showing higher EC are jayal- (Mataji ka Xhoraha) (202500 µS/cm) and Jayal (didwana road) (128000 µS/cm). The Concentration of Chloride in ground water in district varies between 35 mg/l and 6452g/l . The locations showing higher chloride concentration is jayal- (Mataji ka Xhoraha) (6452mg/l). Fluoride concentration in district varies from 0.28mg/l to 10 mg/l with an average of 2.46 mg/l. Highest fluoride value 10 mg/L is found at Nagaur(hs-1). The Concentration of Nitrate in ground water in district varies between 1.0 mg/l to 545 mg/l with an average of 106mg/l. The location showing higher nitrate concentration is Datau(bh) (545mg/l).

8.2.26 Pali

Pali district lies in the south-western part of the state occupying a geographical area of 12357 sq. km. The district is characterized by alluvial plains, Burred pedlplains, hills, lnselbergs and pediments. Luni river and is tributaries namely Lilri, Sukri, Sandi and Jawaih which are ephemeral in nature drains the district. The district experiences arid to semiarid climate. The mean annual rainfall in the district is 752.9 mm.Principal aquifer in the district is Quaternary alluvium and Bilara limestone besides schists, phyllites, Quartzite and granites. 19 water samples were analysed in 2023. EC found in Pali district ranges from 668µS/cm to19180µS/cm with an average of 4418µS/cm. The locations showing higher EC is Shiv Vatika Colony, Vaed (19180µS/cm). The Concentration of Chloride in ground water in district varies between 121 mg/l and 5459g/l . The locations showing higher chloride concentration is Shiv Vatika Colony, Vaed (5459mg/l). Fluoride concentration in district varies from 0.20 mg/l to 6.5 mg/l with an average of 2.46 mg/l. Highest fluoride value 6.5 mg/L is found at Shiv Vatika Colony, Vaed . The Concentration of Nitrate in ground water in district varies between 1.0 mg/l to 545 mg/l with an average of 106mg/l. The location showing higher nitrate concentration is Datau(bh) (545mg/l).

8.2. 27 Pratapgarh

The district experiences semi-humid type of climate with has average annual rainfall of 1978.2 mm. *Groundwater Quality*-7 water samples were analysed in 2023. The slightly alkaline groundwater of the district has medium salinity with the entire area of the district having EC found in Pratapgarh district ranges from 540µS/cm to 2190 µS/cm with an average of 1317µS/cm. The locations showing higher EC are Arnod_Pz (2190 µS/cm). The Concentration of Chloride in ground water in district varies between 35 mg/l and 475mg/l . The locations showing higher chloride concentration is Arnod_Pz (475mg/l). Fluoride concentration in district varies from 0.10mg/l to 1.80 mg/l with an average of 0.55 mg/l. Highest fluoride value is 1.80 mg/l is found at Choti Sadri. The Concentration of Nitrate in ground water in district varies between 22 mg/l to 130 mg/l with an average of 73mg/l. Highest Nitrate value is 130 mg/l is found at Peepalkhoont.

8.2.28 Rajasamand

Geographical area of the district is 4735.46 sq. km, and it lies in the southern part of the State. The district consists of monotonously rolling topography intersected by shallow valleys . The area is drained by Banas river and its tributaries viz. Khari, Chandrabhager etc. The district experiences semi-humid type of climate with has average annual rainfall of 917.6 mm.The schists, gneisses, quartzites and marble of Delhi Super Group;phyllite,quartzite, dolomitic marble of Aravalli Super Group of Bhilwara Super Group from the principal aquifer in the district. *10* water samples were analysed in 2023 . The ground water of the district is slightly alkaline with high salinity. Salinity expressed as EC is beyond 3000 µS/cm. EC found in Rajasamand district ranges from 740µS/cm to3440µS/cm with an average of 1942µS/cm. The locations showing higher EC is found at Railmagra1 (3440µS/cm). The Concentration of Chloride in ground water in district varies between 14 mg/l and 581g/l . The locations showing higher chloride concentration is Railmagra1 (581mg/l). Fluoride concentration in district varies from 0.03 mg/l to 2.50 mg/l with an average of 1.09 mg/l. Highest fluoride value 2.50 mg/L is found at Khamnor1. The Concentration of Nitrate in ground water in district varies between 1.3 mg/l to 137 mg/l with an average of 39mg/l. The location

showing higher nitrate concentration is Deogarh (137mg/l).

8.2.29 Sawai Madhopur

Sawai Madhopur district covers an area of about 5020.65 sq. km and is situated in the eastern part of the state. The district possesses landscapes of isolated hills in central part and alluvium plains in the western part of the district. The district area is drained by perennial Chambal river and ephemeral Sana, Morel, Ghambhir and Banganga river.The district enjoys semiarid to sub-humid climate conditions receiving an average annual rainfall of 897.5 m. Ground water occurs In unconsolidated quaternary formation as well as consolidated formation including schist, gneisses, phyllites, slates, quartzites , limestone and sandstone etc.

11 water samples were analysed in 2023. The ground water of the district is slightly alkaline with high salinity. Salinity expressed as EC is beyond 3000 µS/cm. EC found in Sawaimadhopur district ranges from 570µS/cm to8300µS/cm with an average of 3052µS/cm. The locations showing higher EC is found at Bamnawas (35 and 2269mg/l . The locations showing higher chloride concentration is Bamnawas (2269mg/l). Fluoride concentration in district varies from 0.48 mg/l to 2.30 mg/l with an average of 1.44 mg/l. Highest fluoride value 2.30 mg/l is found at Tond1. The Concentration of Nitrate in ground water in district varies between 0.22 mg/l to 200 mg/l with an average of 58mg/l. The location showing higher nitrate concentration is Tond (Infront of Canara Bank) (200mg/l).

8.2.30 Sikar

Covering an area of about 7880.85 Sikar district occupies north-eastern part of the state. The district area is characterized by the various land form of sandy plains, hills and hillocks and desertic land form. The district in drained by Kantli, Mendha and Sabi-dohan rivers which are ephemeral in nature.The district experiences arid to semiarid climate conditions. The average annual rainfall of the district is 711.9 mm.

The main aquifer in the district in Quaternary alluvium besides quartzite, schist, phyllite, granites etc. 8 water samples were analysed in 2023. The ground water of the district is slightly alkaline with high salinity. Salinity expressed as EC is beyond

3000 µS/cm. EC found in Sikar district ranges from 916µS/cm to3150 µS/cm with an average of 1882µS/cm. The locations showing higher EC is found at Ramgarh (3150µS/cm). The Concentration of Chloride in ground water in district varies between 113 mg/l and 820g/l . The locations showing higher chloride concentration is Ramgarh (820mg/l). Fluoride concentration in district varies from 0.1 mg/l to 2.80 mg/l with an average of 0.94 mg/l. Highest fluoride value 2.80 mg/l is found at Tond1. The Concentration of Nitrate in ground water in district varies between 5.20 mg/l to 190 mg/l with an average of 79mg/l. The location showing higher nitrate concentration is Ramgarh(190mg/l).

8.2.31 Sirohi :

Occupying geographical area of 5136 sq. km. Sirohi district is situated in the south western part of the state. The district area is characterized by occurring of hllls, hillocks, pediments and semi desertic landscapes. It is drained by ephemeral Luni, Jawai, Banas, Khari, Sukri and Sandi rivers. Semiarid climate prevails in the district with an average rainfall of 903.2 mm.The main aquifer in the district is Quartzite alluvium, granites gneisses, schists, phyllites etc.

13 water samples were analysed in 2023. The ground water of the district is slightly alkaline with medium to high salinity. EC found in Sirohi district ranges from 375µS/cm to 5690 µS/cm with an average of 1865µS/cm. The location showing higher EC is Kalandri (5690 µS/cm). The Concentration of Chloride in ground water in district varies between 57 mg/l and 1333mg/l . The location showing higher chloride concentration is Palri Jod (1333mg/l). Fluoride concentration in district varies from 0.2mg/l to 3.60 mg/l with an average of 1.89 mg/l. Highest fluoride value is 3.60 mg/l is found at Kalandri. The Concentration of Nitrate in ground water in district varies between 1mg/l to 400 mg/l with an average of 76 mg/l. Highest Nitrate value is 400 mg/l is found at Sheoganj.

8.2.32 Tonk :

The geographical area of the district is 7200 sq.km and it is situated in eastern part of the State. The area is characterized by flat to undulating topography with small isolated ridges in the western part of Aravalli hills in the south-eastern part. The district is drained by Banas river. The district

experiences semi-arid type of climate having an average annual rainfall of 863.0mm.Quaternary alluvium, shales, dolomitic limestone, phylite, granites and gneisses of Bhilwara Super Group from the principal aquifer in the district. Most conspicuous aquifer in the district is recent alluvium in the form of valley fills.

14 water samples were analysed in 2023.The ground water of the district is slightly alkaline with medium to high salinity. The ground water of the district is slightly alkaline with medium to high salinity. EC found in Tonk district ranges from 750 µS/cm to 14400 µS/cm with an average of 3574µS/cm. The location showing higher EC is Tonk(Raivens Industry) (14400 µS/cm). The Concentration of Chloride in ground water in district varies between 50 mg/l and 4963mg/l . The location showing higher chloride concentration is Tonk(Raivens Industry) (4963mg/l). Fluoride concentration in district varies from 0.30mg/l to 5.30 mg/l with an average of 1.63 mg/l. Highest fluoride value is 5.30 mg/l is found at Jaisinghpur. The Concentration of Nitrate in ground water in district varies between 1.5mg/l to 440 mg/l with an average of 98 mg/l. Highest Nitrate value is 440 mg/l is found at Tonk(Giriraj Temple).

8.2.33 Udaipur

The geographical are of Udaipur district is 12,643.54 sq. km, and it is located in the southern part of the State. The district is characterized by hills and valleys. The area is mainly drained by Banas Ahar, 96 Berach, Wakal and Som river, all of the them are ephemeral in nature.The area experiences semiarid climatic conditions having an average rainfall of 1069.5mm. Schist, gneisses , marble and quartzites of Delhi Super Group and Phyllites, schist, quartzites of Aravalli Super Group from Principal aquifer in the district.12 water samples were analysed in 2023. The ground water of the district is slightly alkaline with medium to high salinity. EC found in Udaipur district ranges from 880 µS/cm to 3130µS/cm with an average of 1680µS/cm. The location showing higher EC is Mavli1 (3130 µS/cm). The Concentration of Chloride in ground water in district varies between 85 mg/l and 581mg/l. The location showing higher chloride concentration is Mavli1 (581mg/l). Fluoride concentration in district varies from 0.03mg/l to 3.32 mg/l with an average of 0.88 mg/l. Highest fluoride value is 3.32 mg/l is found at Semari. The Concentration of nitrate in ground water in district varies between 1.4 mg/l to 213 mg/l with an average of 67 mg/l.

8.3 DISTRICTWISE MAXIMUM VALUE OF EC, FLOURIDE AND NITRATE IN CHARTS (2023):

A comparative analysis of maximum value of Electrical Conductivity in various Districts of Rajasthan during GWM 2023 has been illustrated in given below Plate-24 . It was observed that nitrate values were found to be more than 3000 µS/cm in most of the places in most of the districts.

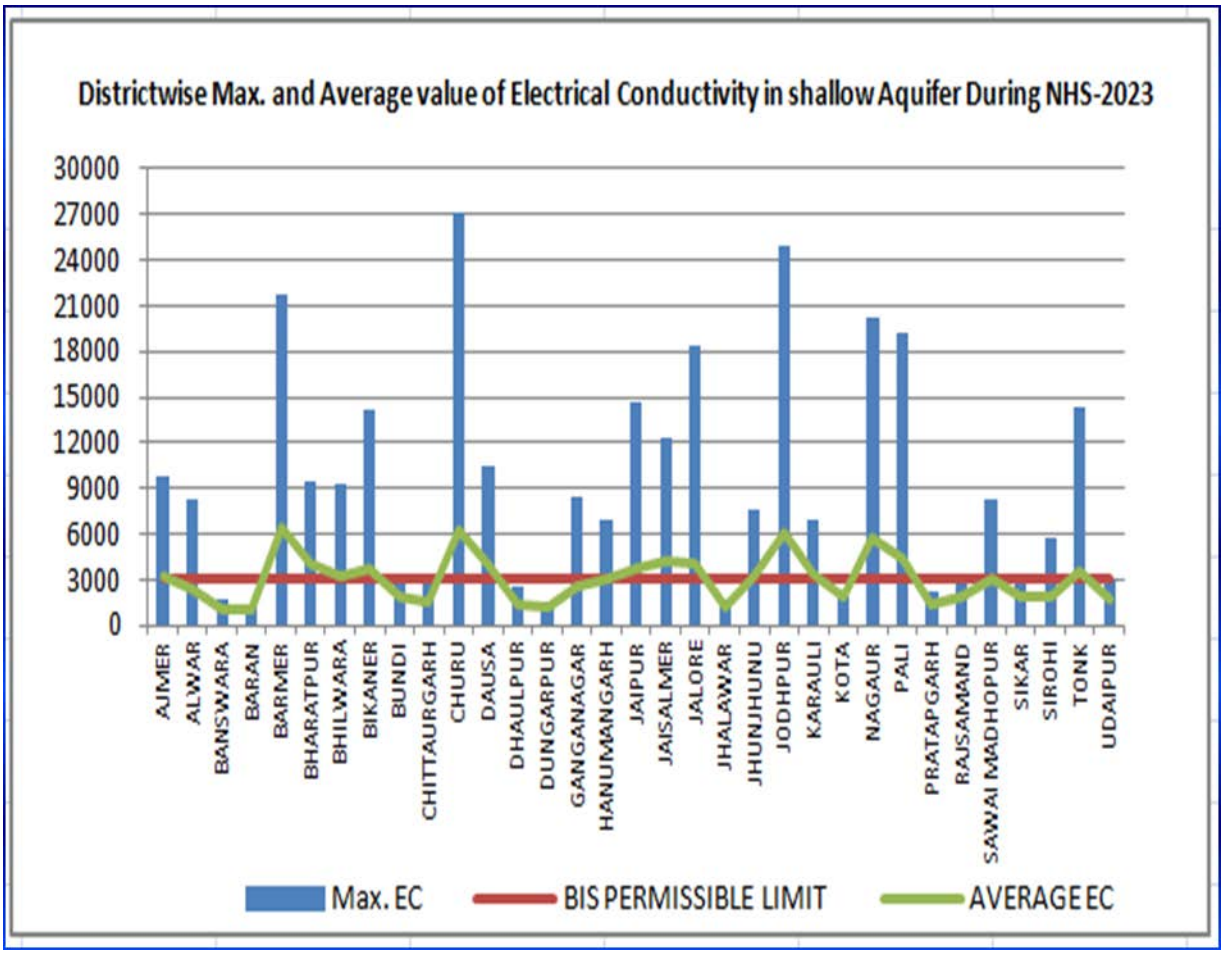


PLATE-24 : CHART SHOWING DISTRICTWISE MAXIMUM EC OBTAINED DURING GWM 2023.

A comparative analysis of maximum value of Fluoride in various Districts of Rajasthan during GWM 2023 has been illustrated in given below Plate-25 . It was observed that fluoride values were found to be more than 1.5 mg/l in most of the places in most of the districts. It can be observed that exept few districts, all have High Flouride in groundwater at various location

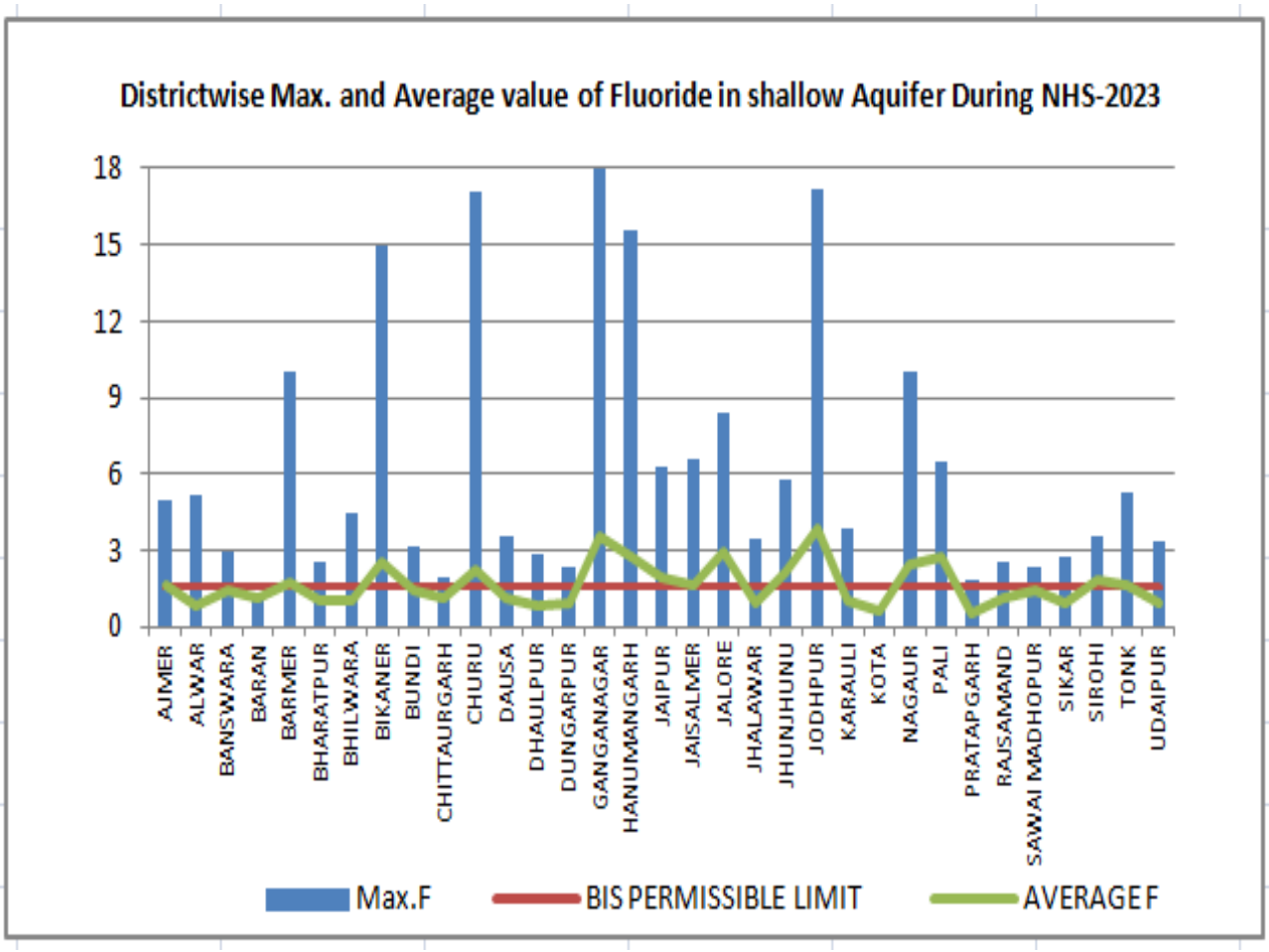


PLATE-25 : PLATE SHOWING DISTRICTWISE MAXIMUM FLUORIDE OBTAINED DURING GWM 2023.

A comparative analysis of maximum value of Nitrate in districts of Rajasthan during GWM 2023 has been illustrated in given below plate- 26 . It was observed that nitrate values were found to be more than 45 mg/l in most of the places in most of the districts. It can be observed that almost all districts have High Nitrate in Rajasthan.

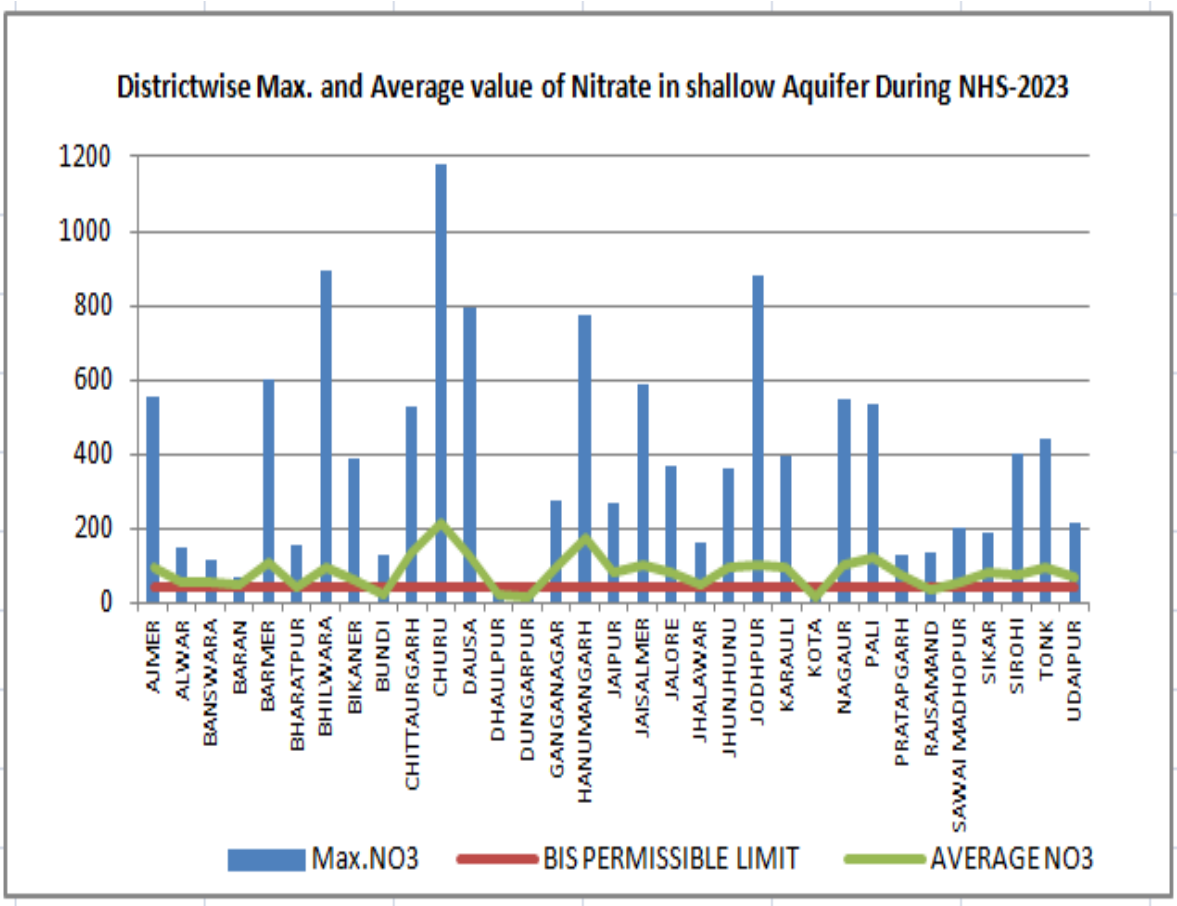


Plate- 26 : Chart Showing Districtwise Maximum Nitrate obtained during GWM 2023

9.0 Major Quality Findings & Possible reasons for any significant change or trend

The evaluation of the ground water quality of the study area for drinking purposes with respect to standards prescribed by BIS (2012) for Basic and heavy metals reveals that-

1. It is observed that **pH** of most of the waters belonging to Rajasthan State fall within the acceptable range of 6.5 to 8.5 during GWM 2023 and Highest value of pH is found at Loona kalan in Barmer district and minimum p H value is found at Rupnagar in Ganganagar district . The pH value of all the waters ranged between 6.68 to 8.92.

2. High **EC** Values > 3000 µS/cm have been found in 307 number of Ground Water samples out of 630 total number of samples analyzed indicating saline nature of water in those 307 locations of the state. Very high EC > 10000 µS/cm, was found at 36 locations. The highest EC value of ground waters in the State is found 27200 µS/cm at Taranagar district Churu at 25°C. Total 7.14 % of them have EC less than 750 µS/cm. 41.30 % have between 750 and 3000 µS/cm and the remaining 48.73 % of the samples have EC above 3000µS/cm. The data showing that less than 750 class of water occur throughout the state in few patches but in high proportion is in northern western parts of the State. The ground water occurring with in permissible limit 2000 mg/l of TDS in the southern and some part in north east and most of part in south west comprising of parts of Banswara,Baran, Daulpur, Dungerpur Jhalawar, Kota and Pratapgarh district. The ground water occurring beyond permissible limit 2000 mg/l of TDS in Barmer (81.48%),Nagaur (74.36%),Jodhpur (69.44%),Jaislmer(63.64 %),Churu (61.36%), Bhartatpur (61.11%), Dausa (60.00%),Jalore (56.62 %), Karauli (54.55%),Jaipur (53.13%),Jhunjhunu (52.63%), Hnaumangarh and Tonk (50% each) & Bikaner(40.54%). Data is reveals that most of west Rajasthan and north west is having very poor water quality for drinking purposes. Data is showing brackish and saline water problem in Rajasthan. In 2023 trend analysis is carried out and found 48.73 % samples having TDS values is beyond permissible limi. Data is reveals that most of west Rajasthan and north west is having very poor water quality for drinking purposes. In 2023 analysis is carried out and found 48.73 %

samples having TDS values is beyond permissible limit. Periodic variation is given below quality continue detoriated from 2020 to 2023. Periodic variation of EC in ground water during the period from 2020 TO 2023 is increasing Trend. More change is show in data from 2022 to 2023 due to revise WQ policy-2023. Most Possible reasons for deteriotion are Agricultural activities: Pesticides, fertilizers, and insecticides used in agriculture can mix into water and affect its quality and geogenic source and less rainfall recharge in ground water, over exploitation of ground water is also reason for high EC in ground water.Industrial waste: waste materials from industries, such as liquids and solids, are dumped into water bodies.

1.0 **Chloride** > 1000mg/l has been found in 61 numbers of Ground Water samples out of 630 total numbers of samples analyzed indicating saline nature of water in that part of the state. Out of 630 sample analysed, 26.51 % have chloride value beyond permissible limit of 1000 mg/l. 40.16 % between acceptable and permissible limit and 33.33 % samples are within acceptable limit. In Nagaur (53.85 %) district, Barmer(51.85%) , Jodhpur (47.22 %), Jaisalmer (39.40%), Jalore (39.13%), & Churu (31.82 %), chloride value is beyond permissible limit. In Banswara, Bundi, Baran, Chittaurgarh Dholpur, Dungarpur,Jhalawar, Kota, Rajsamand Pratapgarh , Sikar,& Udaipur districts, none of the sample shows chloride value beyond permissible limit. Maximum value of chloride (12500 mg/l) Chicharli District Jodhpur . Chloride concentration >3000 mg/l, have been observed in 167 locations in Rajasthan & showing brackish and saline water problem. Possible reasons for deteriotion are Agricultural activities: Pesticides, fertilizers, and insecticides used in agriculture can mix into water and affect its quality and geogenic source and less rainfall recharge in ground water, over exploitation of ground water is also reason for high EC in ground water and I**ndustrial waste**: waste materials from industries, such as liquids and solids, are dumped into water bodies.

2.0 High **Fluoride**>1.5mg/l, which is mainly attributed due to geogenic conditions, have been observed in 275 locations . Ground water samples out of 630 water samples analyzed. 38.73 % samples have fluoride in desirable range, 17.62 % in the permissible and the remaining . 43.65 % have fluoride above 1.50 mg/L. fluoride contents in ground water indicates that ground waters with fluoride above 1.50 mg/L are found mainly in Pali 73.68 %, Jalore 69.57%, Nagaur 66.67% jhunjhunu 63.16% , Sirohi 61.54 % , Jodhpur 61.11 % Jaipur 53.11 %, , Churu 47.53% , Jaisalmer 45.45%, Sawaimadhop[ur 45.45% and ajmer and Banswara 42.86 % each

Barmer 42.59 % and Chittorgarh 40% districts of the State. There is no sample was found beyond the permissible limit in Baran and Kota It is worth mentioning that high fluoride waters are encountered in areas where high salinity is encountered. & highest values of fluoride (18.50 mg/l) have been observed at Birdhwal district Ganganagar. Number of locations are increasing (176 to 275) since 2020 to 2023. High **Fluoride**>1.5mg/l, therefore increasing trend of fluoride is observedin state. The major reason for high fluoride is due to geogenic source and less rainfall recharge in ground water. Over exploitation of ground water is also reason for high fluoride in ground water of state.

3.0 Nitrate : It is found that 50.32 % of the samples, have Nitrate content below the permissible limit and 49.68 % sample having Nitrate content beyond the permissible limits. Maximum value of 1180 mg/l of Nitrate content in ground water is observed at Shawa in Churu district. In ditricts of Pratapgarh (85.71 %) , Barmer (66.67%) Churu and Karauli (63.64 %) each , Baran and chittaurgarh 60.0 % each , Banswara and Tonk 57.14 % each , Jodhpur 56.94% , Hanumangarh and Jaipur 56.25% each , Sikar and Udaipur 50% each Nagaur 48.72%, Bhilawara 48.15%, Jalore 47.83% Pali 47.37% Ganganagar and Sawaimadhopur 45.45% each , Ajmer 42.86% and Alwar 40% having more than permissible limit nitrate value. High **Nitrate**> 45mg/l 253 locations in 2020 , 278 location in 2021, 339 locations in 2022 and 313 locations in 203 , therefore a increasing trend is observed since 2020 to 2023 . Indicating high nitrate pollution due to use of nitrogen containing fertilizer, domestic and agriculture waste and anthropogenic activities.

4.0 **Trace metal /Heavy metals :**In the State, no specific trend for concentration of particular trace element/heavy metals in groundwater is observed out of 232 samples No toxicity has been observed due to heavy metals However, Arsenic, Cadmium, and Zinc are within acceptable drinking water limits in study area and Manganese is found to be present at many places though mostly in low concentrations. A few wells (2.66 %) located in Alwar, Bharatpur, Bhilwara, Chittaurgarh & Dausa have manganese values between the acceptable(0.1mg/l) and permissible(0.3mg/l)limitsof BIS for drinking water . It is found to range from below detection limit to high concentration 0.14 mg/l at Bhagli In Jalore district . The high concentration of Manganese in these areas may be geogenic. About 6.66 % of the wells have recorded more than 0.01mg/l of lead (Pb). Such waters are found in parts of Alwar, Barmer, Bharatpur, Churu, Dhalpur, Hanumangarh, Jaisalmer, Nagaur and Sawaimadhopur one location each and Jalore(3- locations) and Jodhpur(2-locations.) The concentration of Iron in ground water of the State ranges from below detection level to

2.267 mg/l (Hurda, district Bhilwara). Most of the shallow water samples have iron content within the acceptable limit of 1.0mg/l, only about 3.55% water wells recorded its concentration more than more thanacceptable limit 1.0mg/l. The high concentration of Iron in these areas may be geogenic. Thus from the analytical results it has been observed that majority of water samples collected from observation wells of Central Ground Water Board in a major part of the state fall under acceptable or permissible category as far as heavy metal concentration is concerned and hence are suitable for drinking purposes. However, a small percentage of well waters are found to have concentrations of some constituents beyond the permissible limits with respect to heavy metals. Such waters are not fit for human consumption and are likely to be harmful to health on continuous use.

5.0 Uranium : Out of 630 samples where Uranium concentration above 0.030 mg/l is observed in 21 districts out of 33 districts of Rajasthan state ((21.27%) .Most of locations in 10 districts where more than four locations where >30 ppb uranium were found namely Jodhpur , Jaipur, Nagaur, Tonk, Bikaner, Bharatpur, Ganganagar, Churu & remaining 11 districts having one to three locations where more than 30 ppb uranium were found namely Alwar, , Dausa, Hanumangarh, Jaisalmer, Jalore, Jhunjhunu, Karauli, Rajshamand, Swai Madhopur, Sikar and Bhilwara. Districts having greater than 30 ppb uranium in ground water are primarily associated with alluvial aquifer.Elevated levels of uranium in ground water of unconfined alluvium aquifers may be due to redox rections which controls the solubility.Sources include natural deposits , nuclear industry emisssions, coal combsion and phosphate fertilizers .

6.0 Type of water : In general, we can classify the sample points in the piper diagram into 5 fields. They are 1. Ca-HCO_3 type, 2. Ca-Mg- Cl type, 3. Na-Cl type, 4. Na-HCO_3 type and 5. Mixed type. In Piper diagram comprising the 16 districts out of total 33 districts two Piper diagrams was created for the 16 districts namely Ajmer, Alwar, Banswara, Baran, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chhiorgarh, Churu, Dhaulpur, Dausa, Dungarpur, Ganganagar and Hanumangarh that covers the northern and eastern and some central part of Rajasthan state in first piper diagram and for 17 districts Jaipur, Jaisalmer, Jhalawar, Jalor, Jhunjhunu, Jodhpur, Karuli, Kota, Nagaur, Pali, Pratapgarh, Rajsamand, Sawaimadhopur, Sikar, Sirohi, Tonk and Udaipur using the analytical data obtained from the hydrochemical analysis. Majority of the samples (62%) are plotted in the Na-Cl field and 25 % of the samples showed Ca-HCO_3 type. Rest of them was fall in the Ca-SO_4 and Mixed water types Whereas, the second Piper plot that covers the western, central and some

southern part of Rajasthan state, majority of samples around 75% fall in Na-Cl type and Ca-SO4-Cl water types. Only 15% samples having fresh water quality that shown the Ca-HCO3 water type may be due to recharge zone on southern districts that is Pratapgarh, Rajsamand and Udaipur.

7.0 Suitability for drinking and domestic purpose (<u>Water Quality Index</u>): The Ground-water quality index value for drinking and domestic use is calculated for each sample. It has been observed that the majority of the samples (>80%)) belong to the Class I & II category, representative that the water is of good to excellent cquality. While it can also be inferred that about 3.48% water samples were unsuitable for drinking purpose.

8.0 Suitability for Agriculture-

(**<u>Salinity Index</u>**).-

It is found that most of the samples (60.17 %) collected during GWM 2023-24 are categorized under high salinity to extensively high classes.**Percent Sodium :** majority samples (37.45%) fall under Good category in respect to percent sodium (Na) while 28.41% samples were found to be unsuitable for irrigation.

-USSL diagram : USSL Diagram shows that most of the water samples fall in the category C2S1, C3S1, C3S2 and C4S3 and C4S4 indicating medium to very high salinity and sodicity. C2S1, C3S1, C3S2 and C4S2 category water is used for plants with good salt tolerance and C3S3, C4S3 Category water can also used after proper treatment. Category C4S4 is not suitable for agriculture activity.

-SAR values is varies to excellent to good type of water for agriculture in study area and much better quality in post monsoon season. Most of water or more than 73.40 % sample location is suitable for agriculture activity.14.40 % locations water is used after proper treatment. Only 12.20 % locations water is not suitable for agriculture activities.

-RSC values in Rajasthan,70.50% collected water samples are associated with RSC values less than 1.25 and are safe for use in irrigation practices. Only 24.40% water samples are associated with RSC values more than 2.5 and are unsuitable for irrigation.

11.0 Comparative study shows that values of Nitrate, EC,Cl , F ,NO3 and TH having increasing trend in terms of number of samples collected and analysed since 2020 to 2023 and also we concluded that variation trend in value of major parameter is also observed 2020 to 2022 and due to revise policy more variation was observed in major parameters value in 2023 .

10.0 : CONCLUSION AND RECOMMENDATIONS:

The chemical quality of ground water in the state exhibits considerable variation from place to place depending upon the hydrogeology, environment, rain-fall and agricultural activity. Impact of disposable industrial waste in an unsystematic manner without pre-treatment is causing deterioration of ground water quality. Also due to over exploitation of ground water of fresh water zone the water quality has deteriorated.

Out of 630 sample analysed, it is observed that the TDS content is beyond the permissible limit of 2000 mg/l in ground water occurring in Barmer (81.48%),Nagaur (74.36%), Jodhpur (69.44%), Jaislmer(63.64%), Churu (61.36%), Bhartatpur (61.11%), Dausa (60.00%), Jalore (56.62 %),Karauli (54.55%),Jaipur (53.13%),Jhunjhunu (52.63%), Hnaumangarh and Tonk (50% each), Pali947.37%), Bhilwara (44.44%),Ajmer (42.86%) & Bikaner(40.54%). Data reveals that most of Western parts and North West parts of the State are having very poor water quality for drinking water. In 2023 trend analysis was carried out and it was found that 48.73 % samples were having TDS values beyond the permissible limit.

High nitrate h5as also been observed in most of the districts due to unsystematic disposal of faecal and domestic waste and lack of proper sewerage system. High fluoride concentration hazards prevail in majority of the districts . 50.32 % of the samples, spread over the entire State, have nitrate below. 49.68 % samples having beyond the permissible limit . Maximum value of nitrate 1180 mg/l has been observed at Shawa in Churu district. Pratapgarh district 85.71 % , Barmer 66.67% Churu and Karauli 63.64 % each , Baran and chittaurgarh 60.0 % each , Banswara and Tonk 57.14 % each , Jodhpur 56.94% , Hanumangarh and Jaipur 56.25% each , Sikar and Udaipur 50% each Nagaur 48.72%, Bhilawara 48.15%, Jalore 47.83% Pali 47.37% Ganganagar and Sawaimadhopur 45.45% each , Ajmer 42.86% and Alwar 40% having more than permissible limit nitrate value .Out of 809 samples analysed, 17.50 % samples are within Acceptable limit of 200 mg/ l for total hardness. 23.16 % samples have concentration beyond permissible limit while 59.34 % samples fall within acceptable and permissible limits. 26.51 % have chloride value beyond permissible limit of 1000 mg/l 40.16 % between acceptable and permissible limit

and 33.33 % samples are within acceptable limit. In Nagaur (53.85 %)

district, Barmer(51.85%) , Jodhpur (47.22 %), Jaisalmer (39.40%), Jalore (39.13%), & Churu (31.82 %), chloride value is beyond permissible limit.In Banswara, Bundi, Baran, Chittaurgarh Dholpur, Dungarpur,Jhalawar, Kota, Rajsamand Pratapgarh , Sikar,& Udaipur districts, none of the sample shows chloride value beyond permissible limit. Minimum value 7 mg/l is observed at at Rajpura, Churu Block,of Churu District and Maximum value of chloride (12500 mg/l) Chicharli, Luni Block, District Jodhpur.Out of 630 samples analysed,.17.40 % samples are within Acceptable limit of 200 mg/ l for total hardness. 26.80 % samples have concentration beyond permissible limit while 56.03 % samples fall within acceptable and permissible limits. Total hardness above 600 mg/l is found in Hanumangarg (43.75%), Nagaur (43.59%), Bharatpur (40.00%), Churu(38.64%), Bhilwara (37.04%), Gaanganagar, (36.36 %), Jodhpur (30.56%),Jalore (30.43%), districts have Total Hardness concentration beyond permissible limit.. In Banswara, Chittaurgarh, Dhaulpur, Dungarpur, Jhunjhunu, Jhalawara, Sikar & Kota districts none of samples have Total Hardness concentration beyond permissible limit.38.73 % samples have fluoride in desirable range, 17.62 % in the permissible and the remaining43.65 % have fluoride above 1.50 mg/L. Map showing spatial distribution (Figure 7) of fluoride contents in ground water indicates that ground waters with fluoride above 1.50 mg/L are found mainly in Pali 73.68 %, Jalore 69.57%, Nagaur 66.67% jhunjhunu 63.16% , Sirohi 61.54 % , Jodhpur 61.11 % Jaipur 53.11 %, , Churu 47.53% , Jaisalmer 45.45%, Sawaimadhop[ur 45.45% and ajmer and Banswara 42.86 % each Barmer 42.59 % and Chittorgarh 40% districts of the State. There is no sample was found beyond the permissible limit in Baran and Kota It is worth mentioning that high fluoride waters are encountered in areas where high salinity is encountered.In the State, no specific trend for concentration of particular trace element in groundwater is observed. However, arsenic, , cadmium, and Zinc are within acceptable drinking water limits in study area. The manganese is found to be present at many places though mostly in low concentrations. It ranges from below detection limit to 0.832 mg/l 9 (Location - Deeg in district Bharatpur . A few wells (2.66 %) located in Alwar, Bharatpur, Bhilwara, Chittaurgarh & Dausa have manganese values between the acceptable(0.1mg/l) and permissible(0.3mg/l)limitsof BIS for drinking water . It is found to range from below detection limit to high concentration 0.14 mg/l at Bhagli In Jalore district . About 6.66 % of the wells have recorded more than 0.01mg/l of lead. Such waters are found in parts of Alwar, Barmer, Bharatpur, Churu, Dhalpur, Hanumangarh, Jaisalmer, Nagaur and

Sawaimadhopur one location each and Jalore(3- locations) and Jodhpur (2-locations).These waters are not suitable for consumption.The concentration of iron in ground water of the State ranges from below detection level to 2.267 mg/l (Hurda, district Bhilwara). Most of the shallow water samples have iron content within the acceptable limit of 1.0mg/l, only about 3.55% water wells recorded its concentration more than more than acceptable limit 1.0mg/l. Waters high in iron content are found in some parts of districts Ajmer, Bhilwara, Chittaurgarh,Jaipur and Sikar

These waters are not suitable for domestic purpose. Out of 630 samples where Uranium concentration above 0.030 mg/l is observed in 21 districts out of 33 districts of Rajasthan state (21.27%) .Most of locations in 10 districts where more than four locations where >30 ppb uranium were found namely Jodhpur , Jaipur, Nagaur, Tonk, Bikaner, Bharatpur, Ganganagar, Churu & remaining 11 districts having one to three locations where more than 30 ppb uranium were found namely Alwar, , Dausa, Hanumangarh, Jaisalmer, Jalore, Jhunjhunu, Karauli, Rajshamand, Swai Madhopur, Sikar and Bhilwara .One value of uranium 1.035 mg/l is exception one value at Guda Rayka in Jodhpur district. Other high value 0.600 mg/l of uranium is found at Deoli in Tobk district. The uranium content in ground water ranges from BDL to 0.600 mg/L. BIS recommends that uranium concentration up to 0.03 mg/L in drinking water is acceptable. Classification of samples based on this recommendation, it is found that 21.27 % samples have uranium above 0.03 mg/L. Map showing spatial distribution of uranium content in ground water (2023) indicates that ground waters with uranium above 0.03 mg/l are found mainly in 21 district in the state . Alwar , Barmer, Bharatpur, Bhilwara, Bikaner, Churu, Dausa, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Karauli, Nagaur, Pali, Rajsamand, Sawaimadhopur, Sikar, and Tonk. Periodic variation from 2020 to 2023 , the value of uranium location are 8.21 % .Most of water or more than 70.16% sample location is suitable for agriculture activity and 5.08 % locations water is also suitable after proper treatment. Only 24.7640% water samples are associated with RSC values more than 2.5 and are unsuitable for irrigation.

Based on s**alinity Index** It is found that most of the samples (60.17 %) collected during GWM 2023-24 are categorized under high salinity to extensively high classes.

Based on percent Sodium : majority samples (37.45%) fall under Good category in respect to percent sodium (Na) while 28.41% samples were found to be unsuitable for irrigation.

Based on SAR most of water or more than 73.33% sample location is suitable for agriculture

activity 14.44 % locations water is used after proper treatment. Only 12.23 % locations water is not suitable for agriculture activities. In Piper diagram comprising the 16 districts that covers the northern and eastern and some central part of Rajasthan state, majority of the samples (62%) are plotted in the Na-Cl field and 25 % of the samples showed Ca-HCO_3 type. Rest of them was fall in the Ca-SO_4 and Mixed water types and second Piper plot that covers the western, central and some southern part of Rajasthan state, majority of samples around 75% fall in Na-Cl type and Ca-SO_4-Cl water types. Only 15% samples having fresh water quality that shown the Ca-HCO_3 water type .USSL diagram shows that most of the water samples fall in the category C2S1, C3S1, C3S2 and C4S3 and C4S4 indicating medium to very high salinity and sodicity. C2S1, C3S1, C3S2 and C4S2 category water is used for plants with good salt tolerance and C3S3, C4S3 Category water can also used after proper treatment. . Category C4S4 is not suitable for agriculture activity.

Water quality index value for drinking and Domestic use is indicating that 51.43 % samples belong to the Class I & II category, representative that the water is of good to excellent quality. While it can also be inferred that about 7.14 % water samples were unsuitable for drinking purpose.

Comparative study shows that values of Nitrate, EC,Cl , F ,NO_3 and TH having increasing trend in terms of number of samples collected and analysed since 2020 to 2023 and also we concluded that variation trend in value of major parameter is also observed 2020 to 2022 and due to revise policy more variation was observed in major parameters value in 2023

There is progressive increase in ground water draft due to increasing population, urbanization and industrialisation. Any further increase in the draft will aggravate the already worsened situation of declining water levels and/or degrading water quality in some areas.Contamination in ground water may be due to industrial and sewage disposal activities. The ground water development in such areas therefore needs to be regulated through suitable measures to provide sustainability and protection to ground water reservoir.An unsystematic release of industrial waste without pre- disposal treatment is causing deterioration of ground water quality. For Urgent measures including awareness and if need be, punitive action may have to be taken up to stop further degradation in the quality.

Instances of growing levels of nitrates in ground water are noticed due to haphazard disposal of wastes, particularly faecal disposals in urban areas. Educating public regarding the maintenance of hygiene and installation of organized sewerage system are the need of the

hour to reduce these hazards. Large scale artificial recharge of aquifers is need of the hour for improvement of water quality. Ground Water once polluted become difficult and cost extensive for remediation. For this Ground Water resource should be protected from pollution through various measures such as water quality monitoring and survilance development of water quality testing Infrastructure, Research & Development, awareness and capacity building of stake holders etc. Ground water recharge measures are also important for improvement of ground water quality through dilution effect.

Ground water development is a 'People's programme'. Therefore, education and involvement of people in its management projects including development, conservation, protection and augmentation will be the prime requisite to protect resource against quality degradation and guarantee quality assurance.

Artificial recharge of ground water by arresting storm water run-off during monsoon seasons should be the policy directive in all areas with ground water draft more than 90% of the assessed replenishable resource or areas where decline, either in the pre monsoon or post monsoon water levels is observed or the areas where adequate storage capacity is available. The following specific measures will improve the situation and help lessen the stress on the system.

- Paving of surface for providing civic amenities in the towns & cities has led to reduced infiltration and increased run-off during the rainy season. Rainwater harvesting structures should therefore be constructed to intercept and recharge the roof-top run-off from individual house- holds in feasible areas. Local municipal bodies should encourage such a provision.
- Concurrent with the above measures the work of impounding and recharging the storm water run-off from other sources may be adopted. Suitable locations in nalas & gullies should be utilised for the construction of check-dams, sub-surface dams, ponds etc. for ensuring stagnation of water & thus its infiltration underground for augmenting ground water storage. Such structures must be located and designed keeping in full view Geology, Geomorphology and Hydrogeological set-up prevailing in the area.
- Re-use and recycling of urban wastewater should receive added attention of municipal bodies. The liquid urban wastes can be recycled through aquifers to improve their quality and pumped out for reuse particularly for irrigation. It shall however, be essential to ensure that urban & industrial wastes are not inter-mixed. Where such a situation exists, the industrial wastes must be treated before disposal to remove the toxic elements. After primary

treatment the liquid urban wastes can also be used for direct irrigation in suitable areas. It will reduce the dependence on ground water to some extent and shall also ensure conservation and use of the wastewater, which is otherwise lost to evaporation.

- To reduce dependence of ground water, measures aimed at affecting economy in water use be implemented. These could include installation of new small capacity cisterns in toilets and other household means of saving water, use of improved irrigation systems like sprinkler and drip, etc. Wherever feasible, metering of water and charging of economic costs, relocating high water-use industries to surplus water available areas, etc. should be undertaken.

- Instances of growing levels of nitrates in ground water are noticed due to haphazard disposal of wastes, particularly faecal disposals in urban areas. Educating public regarding the maintenance of hygiene and installation of organized sewerage system are the need of the hour to reduce these hazards.

- Disposal of solid wastes in natural or man-made depressions without adequate scientific considerations is bound to pollute ground water in due course. As a measure of precaution, it is therefore essential that solid wastes from major cities and towns should be disposedoff in scientifically located and designed sites/ structures for recycling and reuse. Detailed investigations to locate such sites must be initiated urgently.

- An unsystematic release of industrial waste without pre-disposal treatment is causing deterioration of ground water quality. For example, in Jaipur, the liquid waste from the cloth printing & dyeing industry is leading to an increase in fluoride content in ground water. Urgent measures including awareness and if need be, punitive action may have to be taken up to stop further degradation in the quality. Also, Ground water pollution has become a serious problem due to dyeing & printing industry in Balotra, texture industry in Pali and dyeing & processing industry in Bhilwara areas. Central Ground Water Authority and Pollution Control Boards may consider suitable actions, both preventive and remedial, and drawing up of long-term plans in this regard.

- Since ground water abstraction structures are individually owned, operated and managed, it is difficult to have an account of ground water abstraction by volume. Voluntary registration of structures needs to be encouraged so as to obviate the requirement for enactment and enforcement of any legal measures.

- Whereas restrictions must be laid on the construction and energization of

individually owned structures for drinking and domestic use with a view to avoid wastage of water, but also, adequate supply from municipal water supply system shall have to be ensured in such areas. Also, Ground water markets will have to be regulated.

Keeping in view rapidly declining ground wate trend, Public Interaction Programme is being organized on priority in NAQUIM areas since Ground water development is a 'People's programme'.Therefore, education and involvement of people in its management projects including development, conservation, protection and augmentation will be the prime requisite to protect resource against quality degradation and guarantee quality assurance. Mass awareness programmes aimed at educating the users regarding the adverse effects of over- exploitation of ground water on its quality & quantity, economic and efficient use of water, voluntary regulation of abstraction, etc. will ensure utilisation of the resource at optimal levels.

DISTRICT WISE MINIMUM AND MAXIMUM VALUES OF VARIOUS CHEMICAL CONSTITUENTS, PRE-MONSOON, 2023 Annexure-I

S. No.	DISTRICT	Samples analysed	pH		EC		Cl		SO4		NO3		TH		Ca		Mg		Na		K		F		Fe		TDS	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	AJMER	14	7.15	7.98	575	9740	35	2162	50	1486	0.00	556	210	800	12	160	26.75	150.78	33.00	1872	3.30	56.00	0.17	5.00	0.00	0.00	0	6331
2	ALWAR	15	7.13	8.25	710	8300	21	1843	5	920	5.40	148	170	2060	20	240	17.02	354.00	34.00	964	1.48	8.80	0.11	5.15	0.00	0.00	462	5395
3	BANSWARA	14	6.70	7.78	440	1770	14	220	2	208	1.50	115	150	390	16	92	7.30	53.50	26.00	306	0.55	44.70	0.40	3.00	0.00	0.00	286	1151
4	BARAN	5	7.11	7.70	530	1390	21	135	53	367	20.00	72	180	660	32	172	24.32	60.80	25.00	148	0.15	5.51	0.90	1.30	0.00	0.00	345	904
5	BARMER	54	6.91	8.92	594	21760	57	5034	56	4080	0.00	601	110	2900	16	416	7.30	510.72	45.00	4416	1.20	1030.0	0.10	10.00	0.00	0.00	386	14144
6	BHARATPUR	18	7.08	8.33	720	9420	85	2179	24	1456	1.30	156	90	1540	24	360	7.00	199.00	58.00	1738	1.30	392.00	0.01	2.50	0.00	0.00	468	6123
7	BHILWARA	27	6.95	8.19	390	9380	35	2446	17	1123	1.10	891	160	1680	20	272	21.89	243.20	15.00	1486	0.27	87.00	0.02	4.45	0.00	0.00	254	6097
8	BIKANER	37	7.04	8.56	358	14100	50	4538	2	1200	2.60	390	50	1600	8	364	4.86	304.00	28.63	2836	0.88	173.68	0.10	15.00	0.00	0.00	0	9165
9	BUNDI	9	7.46	8.12	820	3220	43	737	32	542	1.00	129	110	820	16	72	17.02	189.70	77.00	625	0.52	89.50	0.72	3.15	0.00	0.00	533	2093
10	CHITTAURGARH	5	7.13	7.84	590	3300	35	262	1	480	0.53	525	140	590	24	120	19.46	94.85	48.00	477	0.88	29.00	0.15	1.96	0.00	0.00	384	2145
11	CHURU	44	6.86	8.35	136	27200	7	9075	3	4050	2.00	1180	60	6400	12	980	4.86	1070.08	2.40	5500	1.41	1700	0.03	17.10	0.00	0.00	88	17680
12	DAUSA	10	7.14	8.25	469	10410	71	2410	25	947	1.00	794	160	1950	24	400	12.16	267.00	44.79	1480	1.90	74.00	0.09	3.59	0.00	0.00	305	6767
13	DHAULPUR	6	7.66	8.04	790	2530	71	470	34	286	2.60	35	170	360	24	44	27.00	63.00	69.00	414	1.00	59.00	0.01	2.82	0.00	0.00	514	1645
14	DUNGARPUR	4	7.25	7.78	926	1610	78	248	82	198	2.40	26	180	360	28	60	26.75	58.37	80.00	220	1.83	34.00	0.43	2.32	0.00	0.00	602	1047
15	GANGANAGAR	11	6.68	8.04	426	8450	21	2600	2	780	1.00	275	190	2620	24	680	24.32	223.74	20.00	1250	4.80	34.00	0.40	18.20	0.00	0.00	277	5493
16	HANUMANGARH	16	7.10	8.65	316	6990	35	1450	4	1854	2.10	775	120	2100	16	520	9.73	206.72	18.00	1200	3.50	308.25	0.16	15.60	0.00	0.00	205	4544
17	JAIPUR	32	7.00	8.20	760	14700	78	4502	24	1274	1.60	266	60	1600	12	300	7.30	328.32	49.00	2669	1.09	77.53	0.01	6.30	0.00	0.00	494	9555
18	JAISALMER	33	7.30	8.25	760	12350	43	4077	2	1073	1.00	590	110	1180	12	168	14.59	189.70	88.00	2700	2.84	1200	0.40	6.60	0.00	0.00	494	8028
19	JALORE	23	7.14	8.23	680	18400	85	4608	10	1958	1.00	370	90	1850	16	340	7.30	316.16	80.00	3588	1.00	38.00	0.38	8.40	0.00	0.00	442	11960
20	JHALAWAR	12	7.02	8.20	440	1780	35	291	5	186	0.49	165	50	540	8	92	7.30	107.01	17.02	261	0.51	35.00	0.45	3.50	0.00	0.00	286	1157
21	JHUNJHUNU	19	7.08	8.43	582	7560	57	1241	5	1056	1.00	360	110	580	20	136	7.30	116.74	70.00	1580	1.27	10.20	0.02	5.74	0.00	0.00	378	4914
22	JODHPUR	72	7.07	8.74	250	25000	35	12500	10	1780	2.00	880	100	6100	16	920	7.30	948.48	15.00	5850	2.00	98.00	0.20	17.20	0.00	0.00	163	16250
23	KARAULI	11	6.98	8.02	1200	7000	199	1602	81	996	0.21	398	205	1820	32	360	22.00	223.00	126.00	1053	1.80	162.00	0.14	3.90	0.00	0.00	780	4550
24	KOTA	1	7.55	7.55	1920	1920	156	156	370	370	14.20	14	250	250	24	24	46.21	46.21	326.00	326	2.58	2.58	0.64	0.64	0.00	0.00	1248	1248
25	NAGAUR	39	7.30	8.38	370	20250	35	6452	15	2268	1.00	545	60	2500	8	680	9.73	359.94	28.00	4250	0.66	23.00	0.28	10.00	0.00	0.00	241	13163
26	PALI	19	7.16	8.23	668	19180	121	5459	10	1305	1.72	537	120	1650	12	360	14.59	218.88	80.00	3946	1.00	350.00	0.20	6.51	0.00	0.00	434	12467
27	PRATAPGARH	7	7.34	7.78	540	2190	35	475	20	223	22.00	130	180	640	36	168	21.89	102.14	28.00	220	0.48	10.18	0.10	1.80	0.00	0.00	351	1424
28	RAJSAMAND	15	7.05	7.83	740	3440	14	581	34	528	1.30	137	180	870	28	132	24.32	143.49	60.00	398	2.10	46.00	0.03	2.50	0.00	0.00	481	2236
29	SAWAI MADHOPUR	11	7.39	8.21	570	8300	35	2269	20	1045	0.22	200	140	1300	8	72	21.89	282.11	45.00	1661	1.80	1500	0.48	2.30	0.00	0.00	371	5395
30	SIKAR	8	7.40	7.82	916	3150	113	820	8	140	5.20	190	170	560	36	116	17.02	65.66	104.46	488	2.00	7.32	0.10	2.80	0.00	0.00	595	2048
31	SIROHI	13	7.21	8.05	375	5690	57	1333	5	710	1.00	400	130	950	24	152	2.43	141.06	23.00	980	1.00	58.00	0.20	3.60	0.00	0.00	244	3699
32	TONK	14	6.90	8.00	750	14400	50	4963	20	2697	1.50	440	100	6100	8	1064	17.02	836.61	67.00	1760	1.47	61.71	0.30	5.30	0.00	0.00	488	9360
33	UDAIPUR	12	7.27	8.12	880	3130	85	581	32	214	1.40	213	230	810	16	128	41.34	158.08	75.00	342	2.30	1070	0.03	3.32	0.00	0.00	572	2035
Total		630	6.68	8.92	136	27200	7	12500	1	4080	0.00	1180	50	6400	8	1064	2.43	1070	2	5850	0.15	392	0.01	18.20	0.00	0.00	0	17680

DISTRICT WISE DISTRIBUTION (%) OF MAJOR CONSTITUENTS WITHIN ACCEPTABLE LIMIT, PERMISSIBLE LIMIT AND BEYOND PERMISSIBLE LIMIT - PRE-MONSOON, 2023

Annexure-II

S. No.	DISTRICT	Samples	TDS			CHLORIDE			SULPHATE			FLUORIDE			NITRATE		TH			Ca			Mg			EC			
			0-500	501-2000	>2000	0-250	251-1000	>1000	0-200	201-400	>400	0-1.0	1.01-1.5	>1.5	0-45	> 45	0-200	201-600	>600	0-75	76-200	>200	0-30	31-100	>100	0-750	751-1500	1500 - 3000	>3000
1	AJMER	14	7.14	50.00	42.86	42.86	42.86	14.29	50.00	21.43	28.57	28.57	28.57	42.86	57.14	42.86	-	71.43	28.57	71.43	28.57	-	14.29	64.29	21.43	7.14	21.43	28.57	42.86
2	ALWAR	15	6.67	80.00	13.33	53.33	40.00	6.67	60.00	20.00	20.00	86.67	-	13.33	60.00	40.00	13.33	60.00	26.67	40.00	46.67	13.33	33.33	53.33	13.33	6.67	20.00	60.00	13.33
3	BANSWARA	14	14.29	85.71	-	100.00	-	-	92.86	7.14	-	50.00	7.14	42.86	42.86	57.14	35.71	64.29	-	92.86	7.14	-	35.71	64.29	-	14.29	64.29	21.43	-
4	BARAN	5	40.00	60.00	-	100.00	-	-	80.00	20.00	-	40.00	60.00	-	40.00	60.00	20.00	60.00	20.00	80.00	20.00	-	40.00	60.00	-	40.00	60.00	-	-
5	BARMER	54	1.85	16.67	81.48	7.41	40.74	51.85	14.81	25.93	59.26	31.48	25.93	42.59	33.33	66.67	9.26	61.11	29.63	55.56	37.04	7.41	14.81	53.70	31.48	1.85	1.85	14.81	81.48
6	BHARATPUR	18	5.56	38.89	55.56	27.78	44.44	27.78	27.78	38.89	33.33	55.56	11.11	33.33	72.22	27.78	11.11	50.00	38.89	55.56	38.89	5.56	11.11	55.56	33.33	5.56	5.56	27.78	61.11
7	BHILWARA	27	14.81	40.74	44.44	40.74	40.74	18.52	48.15	22.22	29.63	74.07	3.70	22.22	51.85	48.15	7.41	55.56	37.04	51.85	37.04	11.11	11.11	55.56	33.33	14.81	11.11	29.63	44.44
8	BIKANER	37	10.81	48.65	37.84	35.14	37.84	27.03	48.65	32.43	18.92	40.54	24.32	35.14	67.57	32.43	29.73	45.95	24.32	64.86	29.73	5.41	32.43	48.65	18.92	10.81	18.92	29.73	40.54
9	BUNDI	9	-	88.89	11.11	55.56	44.44	-	66.67	11.11	22.22	33.33	33.33	33.33	88.89	11.11	11.11	77.78	11.11	100.00	-	-	11.11	66.67	22.22	-	44.44	44.44	11.11
10	CHITTAURGARH	5	20.00	60.00	20.00	80.00	20.00	-	80.00	-	20.00	40.00	20.00	40.00	40.00	60.00	20.00	80.00	-	40.00	60.00	-	20.00	80.00	-	20.00	60.00	-	20.00
11	CHURU	44	11.36	29.55	59.09	18.18	50.00	31.82	47.73	20.45	31.82	34.09	18.18	47.73	36.36	63.64	25.00	36.36	38.64	68.18	18.18	13.64	25.00	36.36	38.64	11.36	4.55	22.73	61.36
12	DAUSA	10	10.00	40.00	50.00	30.00	50.00	20.00	30.00	30.00	40.00	40.00	40.00	20.00	60.00	40.00	10.00	50.00	40.00	50.00	40.00	10.00	10.00	60.00	30.00	10.00	10.00	20.00	60.00
13	DHAULPUR	6	-	100.00	-	83.33	16.67	-	66.67	33.33	-	83.33	-	16.67	100.00	-	16.67	83.33	-	100.00	-	-	33.33	66.67	-	-	83.33	16.67	-
14	DUNGARPUR	4	-	100.00	-	100.00	-	-	100.00	-	-	75.00	-	25.00	100.00	-	25.00	75.00	-	100.00	-	-	25.00	75.00	-	-	75.00	25.00	-
15	GANGANAGAR	11	18.18	54.55	27.27	54.55	27.27	18.18	45.45	36.36	18.18	54.55	9.09	36.36	54.55	45.45	18.18	45.45	36.36	45.45	45.45	9.09	36.36	36.36	27.27	18.18	27.27	27.27	27.27
16	HANUMANGARH	16	12.50	37.50	50.00	50.00	43.75	6.25	43.75	18.75	37.50	56.25	12.50	31.25	43.75	56.25	12.50	43.75	43.75	56.25	18.75	25.00	6.25	50.00	43.75	12.50	6.25	31.25	50.00
17	JAIPUR	32	3.13	43.75	53.13	28.13	56.25	15.63	56.25	25.00	18.75	37.50	9.38	53.13	43.75	56.25	3.13	68.75	28.13	59.38	37.50	3.13	3.13	71.88	25.00	-	21.88	25.00	53.13
18	JAISALMER	33	3.03	33.33	63.64	9.09	51.52	39.39	39.39	33.33	27.27	39.39	15.15	45.45	60.61	39.39	18.18	60.61	21.21	72.73	27.27	-	24.24	54.55	21.21	-	9.09	27.27	63.64
19	JALORE	23	8.70	34.78	56.52	30.43	30.43	39.13	43.48	34.78	21.74	8.70	21.74	69.57	52.17	47.83	34.78	34.78	30.43	69.57	13.04	17.39	39.13	43.48	17.39	8.70	13.04	21.74	56.52
20	JHALAWAR	12	16.67	83.33	-	66.67	33.33	-	100.00	-	-	75.00	16.67	8.33	66.67	33.33	33.33	66.67	-	83.33	16.67	-	58.33	33.33	8.33	8.33	66.67	25.00	-
21	JHUNJHUNU	19	10.53	36.84	52.63	31.58	63.16	5.26	52.63	21.05	26.32	26.32	10.53	63.16	36.84	63.16	36.84	63.16	-	94.74	5.26	-	31.58	52.63	15.79	10.53	15.79	21.05	52.63
22	JODHPUR	72	4.17	27.78	68.06	9.72	43.06	47.22	36.11	29.17	34.72	13.89	25.00	61.11	43.06	56.94	19.44	50.00	30.56	52.78	38.89	8.33	29.17	45.83	25.00	4.17	4.17	22.22	69.44
23	KARAULI	11	-	45.45	54.55	27.27	54.55	18.18	45.45	27.27	27.27	54.55	27.27	18.18	36.36	63.64	-	72.73	27.27	45.45	36.36	18.18	18.18	54.55	27.27	-	18.18	27.27	54.55
24	KOTA	1	-	100.00	-	100.00	-	-	-	100.00	-	100.00	-	-	100.00	-	-	100.00	-	100.00	-	-	-	100.00	-	-	-	100.00	-
25	NAGAUR	39	2.56	23.08	74.36	17.95	28.21	53.85	25.64	17.95	56.41	20.51	12.82	66.67	51.28	48.72	12.82	43.59	43.59	71.79	20.51	7.69	12.82	41.03	46.15	2.56	15.38	7.69	74.36
26	PALI	19	5.26	47.37	47.37	26.32	47.37	26.32	42.11	21.05	36.84	10.53	15.79	73.68	52.63	47.37	15.79	57.89	26.32	63.16	31.58	5.26	21.05	52.63	26.32	5.26	15.79	31.58	47.37
27	PRATAPGARH	7	14.29	85.71	-	71.43	28.57	-	71.43	28.57	-	85.71	-	14.29	14.29	85.71	14.29	57.14	28.57	57.14	42.86	-	14.29	71.43	14.29	14.29	57.14	28.57	-
28	RAJSAMAND	15	6.67	80.00	13.33	53.33	46.67	-	60.00	20.00	20.00	46.67	20.00	33.33	60.00	40.00	6.67	73.33	20.00	73.33	26.67	-	13.33	66.67	20.00	6.67	26.67	53.33	13.33
29	SAWAI MADHOPUR	11	9.09	63.64	27.27	54.55	27.27	18.18	45.45	36.36	18.18	27.27	27.27	45.45	54.55	45.45	27.27	63.64	9.09	100.00	-	-	27.27	54.55	18.18	9.09	27.27	36.36	27.27
30	SIKAR	8	-	87.50	12.50	50.00	50.00	-	100.00	-	-	62.50	25.00	12.50	50.00	50.00	12.50	87.50	-	75.00	25.00	-	37.50	62.50	-	-	37.50	50.00	12.50
31	SIROHI	13	30.77	53.85	15.38	53.85	30.77	15.38	84.62	7.69	7.69	30.77	7.69	61.54	61.54	38.46	30.77	46.15	23.08	53.85	46.15	-	61.54	23.08	15.38	30.77	23.08	30.77	15.38
32	TONK	14	7.14	42.86	50.00	50.00	28.57	21.43	42.86	28.57	28.57	42.86	21.43	35.71	42.86	57.14	14.29	64.29	21.43	85.71	7.14	7.14	14.29	50.00	35.71	7.14	7.14	35.71	50.00
33	UDAIPUR	12	-	91.67	8.33	66.67	33.33	-	83.33	16.67	-	83.33	-	16.67	50.00	50.00	-	75.00	25.00	83.33	16.67	-	-	75.00	25.00	-	58.33	33.33	8.33
Total		630	8.94	57.94	33.33	49.27	34.90	15.83	55.49	23.80	20.70	48.15	16.66	35.20	55.31	44.69	16.52	61.98	21.50	70.10	24.82	5.08	23.20	56.96	19.84	8.51	28.22	29.58	33.70

DISTRICTWISE PERCENTAHE OF STATIONS WHERE THE PRINCIPAL CHEMICAL CONSTITUENTS ARE BEYOND PERMISSIBLE LIMITS FOR DRINKING WATER -PRE-MONSOON, 2023 – **Annexure-III**

S.No.	District	Samples analysed	TDS	Cl	SO4	F	NO3	TH	Ca	Mg
1	AJMER	14	42.86	14.29	28.57	42.86	42.86	28.57	0.00	21.43
2	ALWAR	15	13.33	6.67	20.00	13.33	40.00	26.67	13.33	13.33
3	BANSWARA	14	0.00	0.00	0.00	42.86	57.14	0.00	0.00	0.00
4	BARAN	5	0.00	0.00	0.00	0.00	60.00	20.00	0.00	0.00
5	BARMER	54	81.48	51.85	59.26	42.59	66.67	29.63	7.41	31.48
6	BHARATPUR	18	55.56	27.78	33.33	33.33	27.78	38.89	5.56	33.33
7	BHILWARA	27	44.44	18.52	29.63	22.22	48.15	37.04	11.11	33.33
8	BIKANER	37	37.84	27.03	18.92	35.14	32.43	24.32	5.41	18.92
9	BUNDI	9	11.11	0.00	22.22	33.33	11.11	11.11	0.00	22.22
10	CHITTAURGARH	5	20.00	0.00	20.00	40.00	60.00	0.00	0.00	0.00
11	CHURU	44	59.09	31.82	31.82	47.73	63.64	38.64	13.64	38.64
12	DAUSA	10	50.00	20.00	40.00	20.00	40.00	40.00	10.00	30.00
13	DHAULPUR	6	0.00	0.00	0.00	16.67	0.00	0.00	0.00	0.00
14	DUNGARPUR	4	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00
15	GANGANAGAR	11	27.27	18.18	18.18	36.36	45.45	36.36	9.09	27.27
16	HANUMANGARH	16	50.00	6.25	37.50	31.25	56.25	43.75	25.00	43.75
17	JAIPUR	32	53.13	15.63	18.75	53.13	56.25	28.13	3.13	25.00
18	JAISALMER	33	63.64	39.39	27.27	45.45	39.39	21.21	0.00	21.21
19	JALORE	23	56.52	39.13	21.74	69.57	47.83	30.43	17.39	17.39
20	JHALAWAR	12	0.00	0.00	0.00	8.33	33.33	0.00	0.00	8.33
21	JHUNJHUNU	19	52.63	5.26	26.32	63.16	63.16	0.00	0.00	15.79
22	JODHPUR	72	68.06	47.22	34.72	61.11	56.94	30.56	8.33	25.00
23	KARAULI	11	54.55	18.18	27.27	18.18	63.64	27.27	18.18	27.27
24	KOTA	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	NAGAUR	39	74.36	53.85	56.41	66.67	48.72	43.59	7.69	46.15
26	PALI	19	47.37	26.32	36.84	73.68	47.37	26.32	5.26	26.32
27	PRATAPGARH	7	0.00	0.00	0.00	14.29	85.71	28.57	0.00	14.29
28	RAJSAMAND	15	13.33	0.00	20.00	33.33	40.00	20.00	0.00	20.00
29	SAWAI MADHOPUR	11	27.27	18.18	18.18	45.45	45.45	9.09	0.00	18.18
30	SIKAR	8	12.50	0.00	0.00	12.50	50.00	0.00	0.00	0.00
31	SIROHI	13	15.38	15.38	7.69	61.54	38.46	23.08	0.00	15.38
32	TONK	14	50.00	21.43	28.57	35.71	57.14	21.43	7.14	35.71
33	UDAIPUR	12	8.33	0.00	0.00	16.67	50.00	25.00	0.00	25.00

DISTRIBUTION (%) OF MAJOR CONSTITUENTS in state WITHIN ACCEPTABLE LIMIT, PERMISSIBLE LIMIT

AND BEYOND PERMISSIBLE LIMIT - PRE-MONSOON, 2023 **Annexure-IV**

S.No.	Limit	CONSTITUENTS IN PERCENT									
		TDS	Cl	SO4	F	NO3	TH	Ca	Mg	RANGE	EC
1	Acceptable limit	8.94	49.27	55.49	48.15	55.31	16.52	70.10	23.20	0-750	8.51
2	Permissible Limit	57.94	34.90	23.80	16.66		61.98	24.82	56.96	750-1500	28.2
3	Beyond Permissible	33.03	15.83	20.70	35.20	44.69	21.50	5.08	19.84	1500-3000	29.58
										>3000	33.7

Chemical analysis results of water samples collected during NHS monitoring 2023-24(May-2023) Annexure-V

Lab Id	District	Block	Location	Aqui- fer	Lat.	Long.	pH	EC(µS/cm at 25 deg.cel)	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	PO4 mg/l	F mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	TDS mg/l	U mg/l
4U/1	RAJSAMAND	Bhim	Bhim	BW	25.74	74.08	7.37	2335	0	415	432	194	14	0.11	2.01	490	80	71	305	13	1518	33
4U/2	RAJSAMAND	Bhim	THIKARWAS	HP	25.61	73.97	7.28	1230	0	309	106	186	18	0.13	1.53	250	52	29	168	3.5	800	8.9
4U/3	RAJSAMAND	Deogarh	Deogarh	HP	25.53	73.91	7.21	2280	0	415	326	218	137	0.19	0.78	550	60	97	264	15	1482	13
4U/4	RAJSAMAND	Bhim	DEWAIR	DW	25.42	73.82	7.38	930	0	440	35	34	17	0.16	1.22	330	56	46	60	5	605	7.8
4U/5	RAJSAMAND	Rajsamand	RAJSAMAND	DW	25.07	73.88	7.73	2270	0	695	241	184	35	0.09	1.38	480	40	92	275	46	1476	6.7
4U/6	RAJSAMAND	Amet	NADIAWALA	HP	25.18	73.86	7.05	2200	0	464	291	254	54	0.14	0.08	500	56	88	269	12	1430	6.2
4U/7	RAJSAMAND	Amet	Gugli	DW	25.23	73.88	7.33	2740	0	500	482	432	67	0.10	0.03	830	104	139	346	12	1781	31
4U/8	RAJSAMAND	Amet	AMET	HP	25.30	73.92	7.3	2590	0	378	369	403	55	0.09	0.11	470	54	81	373	12	1684	12
4U/9	RAJSAMAND	Railmagra	RAILMAGRA1	DW	25.03	74.11	7.61	3440	0	732	581	246	54	0.13	0.07	850	104	143	398	5.8	2236	7.3
4U/10	UDAIPUR	Bhindar	KHERODA	HP	24.58	74.06	7.64	2910	0	354	546	214	213	0.13	0.03	780	128	112	308	7.1	1892	0.6
4U/11	UDAIPUR	Bhindar	BHINDER	HP	24.51	74.19	7.85	2210	0	537	284	86	212	0.08	0.73	490	84	68	239	75	1437	0.67
4U/12	UDAIPUR	Mavli	Mavli1	HP	24.79	73.98	7.32	3130	0	622	581	155	91	0.13	0.25	810	64	158	342	12	2035	6.1
4U/13	RAJSAMAND	Railmagra	KHETI KHERA (DHANERIYA)	HP	24.87	74.10	7.32	740	0	293	14	96	6	0.02	1.59	180	32	24	87	2.1	481	5.9
4U/14	RAJSAMAND	Railmagra	GAVARDI	DW	24.92	74.10	7.83	1510	0	537	149	81	21	0.14	1.37	300	68	32	208	5.6	982	27
4U/15	RAJSAMAND	Railmagra	DARIBA	HP	24.96	74.11	7.64	3320	0	512	468	528	34	0.04	0.99	870	132	131	359	10	2158	17
4U/16	UDAIPUR	Gogunda	JASWANTGARH	HP	24.79	73.46	7.27	1225	0	415	99	89	46	0.09	0.67	380	56	58	101	11	796	2.9
4U/17	RAJSAMAND	Kumbhalgarh	Kumbhalgarh	HP	25.13	73.58	7.5	870	0	385	35	52	13	0.09	0.88	220	28	36	94	9	566	0
4U/18	RAJSAMAND	Khamnor	KHAMNOR1	BW	24.92	73.72	7.37	1630	0	525	199	50	54	0.13	2.50	380	45	65	189	20	1060	11
4U/19	UDAIPUR	BADGAON	CHIRWA	HP	24.70	73.74	7.54	1050	0	195	142	152	1.4	0.10	1.92	330	36	58	90	2.3	683	0
4U/20	UDAIPUR	Girwa	SAVINA	HP	24.56	73.71	7.73	1390	0	232	205	201	6.3	0.06	0.12	360	36	66	152	4.1	904	0.97
4U/21	CHITTAURGARH	Bhadesar	BANSEN	DW	24.73	74.45	7.15	1220	0	317	113	127	70	0.05	0.31	470	112	46	63	4.1	793	3.9
4U/22	CHITTAURGARH	BEGUN	DUGAR	HP	25.12	74.84	7.25	1240	0	378	99	110	68	0.04	0.15	480	120	44	48	29	806	5.7

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4U/23	CHITTAURGARH	Chittaurgarh	Purohitokasavat	BW	24.94	74.53	7.13	1360	0	451	156	81	0.53	0.01	1.96	370	44	63	135	14	884	28
4U/24	CHITTAURGARH	Kapasan	Mungana	HP	24.88	74.27	7.4	3300	0	427	262	480	525	0.03	1.96	590	80	95	477	20	2145	12
4U/25	BHILWARA	Mandalgarh	MANDALGARH1	HP	25.21	75.09	7.53	6590	0	744	1134	1008	40	0.02	0.49	780	96	131	1148	18	4284	28
4U/26	BHILWARA	Asind	Jeewaliya	BW	25.53	74.53	7.36	3540	0	610	624	336	40	0.01	2.05	410	32	80	621	8.8	2301	13
4U/27	BHILWARA	MANDAL	BHAGWANPURA	HP	25.53	74.44	7.68	1600	0	561	156	100	11	0.12	1.70	340	40	58	208	6.5	1040	2.9
4U/28	BHILWARA	Mandal	Mandal	HP	25.45	74.57	7.74	3110	0	598	603	142	69	0.02	4.06	320	24	63	565	6.9	2022	12
4U/29	BHILWARA	Mandal	Dahimatha	DW	25.53	74.28	7.35	5870	0	439	1375	576	39	0.01	0.93	1000	136	161	883	13	3816	15
4U/30	BHILWARA	ASIND	TILOLI	HP	25.59	74.31	7.45	1780	0	525	148	208	46	0.05	0.54	430	68	63	200	26	1157	4.2
4U/31	BHILWARA	ASIND	DAULATGARH	HP	25.64	74.33	7.27	4470	0	573	992	286	82	0.17	0.14	1040	160	156	547	5.5	2906	9.1
4U/32	BHILWARA	Sahara	GANGAPUR1	DW	25.22	74.26	7.55	1620	0	317	206	116	167	0.11	1.30	310	52	44	228	6.5	1053	19
4U/33	BHILWARA	Kotri	KOTARI	HP	25.40	74.89	7.18	7520	0	769	1276	586	891	0.06	0.28	1680	272	243	921	69	4888	6.6
4U/34	BHILWARA	Mandal	malas	HP	25.52	74.33	7.47	2635	0	610	397	194	64	0.08	0.81	690	104	105	282	13	1713	5.2
4U/35	BHILWARA	Shahpura	Bhojpur_Pz	HP	25.45	74.86	7.81	1775	0	403	297	120	16	0.13	0.06	440	36	85	195	19	1154	4.6
4U/36	BHILWARA	BANERA	BANERA	HP	25.50	74.69	7.39	1000	0	451	50	36	26	0.14	0.55	380	76	46	29	46	650	0
4U/37	BHILWARA	Kotri	SAWAIPUR	DW	25.31	74.87	7.28	2080	0	290	227	388	92	0.25	0.43	640	132	75	180	7.4	1352	0.11
4U/38	BHILWARA	MANDALGARH	BIGOD	DW	25.24	75.04	7.48	730	0	244	71	41	27	0.04	0.04	270	28	49	44	1.9	475	3.4
4U/39	BHILWARA	Mandalgarh	MANDALGARH1	HP	25.21	75.09	7.55	1250	0	476	85	49	61	0.11	4.45	250	20	49	173	0.27	813	1.7
4U/40	BHILWARA	Mandalgarh	SALAWATIYA	DW	25.11	75.26	6.95	390	0	67	35	62	29	0.21	0.38	160	24	24	15	4.2	254	1.1
4U/41	BHILWARA	Bijoliya	Rampuriya_Pz	BW	25.29	75.33	7.85	7000	0	866	1098	1123	76	0.10	0.83	1250	260	146	1035	1.5	4550	12
4U/42	BHILWARA	Bijoliya	MANGTALA	HP	25.36	75.31	8.19	4590	0	1061	411	683	165	0.10	0.45	460	72	68	846	0.4	2984	1.05
5U/1	JHUNJHUNU	Nawalgarh	Nawalgarh	TW	27.85	75.25	7.39	1250	0	390	156	50	70	0.05	2.45	150	20	24	231.45	1.81	813	2

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5U/2	JHUNJHUNU	NAWALGARH	MUKUNDGARH	TW	27.95	75.22	7.85	1640	0	573	213	51	60	0.07	0.60	200	24	34	308.7	1.96	1066	25
5U/3	JHUNJHUNU	JHUNJHUNUN	Math	TW	28.18	75.45	7.42	1500	0	342	284	36	61	0.11	0.02	240	44	32	241.85	2.13	975	21
5U/4	JHUNJHUNU	CHIRAWA	Khudana	TW	28.19	75.52	7.65	1160	0	476	113	32	34	0.02	0.50	110	32	7	231.85	1.53	754	15
5U/5	JHUNJHUNU	Chirawa	Chirawa	TW	28.23	75.65	7.51	2850	0	293	659	170	1	0.04	2.10	510	136	41	383.7	10.2	1853	6
5U/6	JHUNJHUNU	CHIRAWA	MANDRELA	TW	28.31	75.44	7.68	3300	0	488	624	285	55	0.03	1.60	400	68	56	563.8	2.12	2145	50
5U/7	JHUNJHUNU	ALSISAR	CHURELA	TW	28.16	75.26	7.68	1960	0	488	291	65	155	0.02	1.25	190	20	34	376.3	1.27	1274	20
5U/8	JHUNJHUNU	Jhunjhunu	Jhunjhunu	TW	28.11	75.39	7.08	581.8	0	207	64	22	28	0.05	0.10	110	28	10	88.46	3.05	378	32
5U/9	JHUNJHUNU	UDAIPURWATI	UDAIPURWATI	TW	27.72	75.48	7.7	710.1	0	329	57	5	11	0.02	0.10	210	52	19	70	3.04	462	5
5U/10	SIKAR	SRIMADHOPUR	Ajitgarh	TW	27.42	75.82	7.82	2130	0	427	468	20	32	0.02	0.10	230	52	24	377.15	7	1385	11
5U/11	SIKAR	Neem Ka Thana	Neem Ka Thana	TW	27.74	75.79	7.74	1070	0	439	113	8	40	0.02	0.52	330	56	46	104.46	3.21	696	25
5U/12	SIKAR	PATAN	PATAN	TW	27.80	75.98	7.52	915.9	0	366	250	46	5.2	0.04	0.80	220	48	24	223.9	4.41	595	24
5U/13	ALWAR	THANAGAZI	Bairawas	TW	27.46	76.40	7.44	1550	0	390	241	330	44	0.08	0.45	790	108	126	114.37	4.58	1008	25
5U/14	ALWAR	KUSHAKGARH	KUSHALGARH	TW	27.47	76.44	7.13	1740	0	512	234	5	144	0.07	0.20	640	176	49	102	7.65	1131	10
5U/15	ALWAR	Mandawar	Mandawar	TW	27.87	76.55	7.35	1980	0	525	291	25	148	0.02	0.15	650	224	22	151.32	6.04	1287	36
5U/16	ALWAR	KISHANGARH BAS	BOLNI	TW	27.87	76.80	7.6	1670	0	671	184	10	23	0.01	5.15	170	20	29	312.25	1.81	1086	16
5U/17	ALWAR	TIJARA	TAPUKARA	TW	28.11	76.84	7.22	1410	0	525	128	8	120	0.02	0.52	370	80	41	160	1.75	917	5
5U/18	ALWAR	TIJARA	TIJARA1	TW	27.93	76.86	7.46	785.6	0	300	106	17	33	0.04	0.15	180	40	19	120	1.53	511	5
5U/19	ALWAR	RAMGARH	RAMGARH1	TW	27.59	76.81	7.35	2870	0	620	360	465	6.3	0.05	0.40	510	84	73	458.8	2.25	1866	1
5U/20	ALWAR	BANSUR	BANSUR	TW	27.69	76.36	7.74	1410	0	756	113	15	13	0.02	0.15	350	40	61	209.72	1.48	917	15
5U/21	ALWAR	NEEMRANA	Neemrana	TW	28.00	76.39	7.65	1760	0	464	220	102	38	0.04	0.11	210	56	17	285.3	1.64	1144	14
5U/22	JAIPUR	Kotputli	Kotputli	HP	27.70	76.19	7.75	2680	0	476	525	42	120	0.09	0.75	340	60	46	429.5	2.08	1742	13
5U/23	JAIPUR	Paota	Paota	TW	27.58	76.08	7.48	1850	0	378	320	46	39	0.11	0.15	450	108	44	180	3.17	1203	10
5U/24	DAUSA	LAWAN	LAWAN1	TW	26.78	76.22	7.77	468.9	0	159	71	25	1	0.02	0.35	160	44	12	44.79	4.25	305	0.72

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5U/25	JAIPUR	JAMWA RAMGARH	RASALA	TW	27.11	76.20	8.06	930	0	512	99	60	11	0.02	0.21	230	28	39	184.66	2.38	605	4.5
5U/26	JAIPUR	GOVINDGARH	Kanarpura	TW	27.18	75.57	7.95	951.6	0	476	92	75	16	0.11	0.90	220	24	39	181.02	1.83	619	12.6
5U/27	JAIPUR	JHOTWARA	Jaisingpur Khor	TW	26.94	75.88	7.5	3570	0	451	858	105	180	0.02	0.35	960	104	170	388.15	26.11	2321	39.8
5U/28	SIKAR	Dtaramgarh	Khatusyamgi	TW	27.36	75.40	7.68	2100	0	622	298	140	122	0.01	0.20	370	60	54	368.1	3.7	1365	19.3
6U/1	JHUNJHUNU	Alsisar	Kankaru khurd	TW	28.31	75.34	7.80	4600	0	1025	610	530	350	0.25	2.46	540	48	102	920	3.3	2990	25
6U/2	JHUNJHUNU	Alsisar	Bhara ks bas	TW	28.31	75.32	8.01	4380	0	1196	581	408	110	0.16	5.74	220	40	29	970	1.59	2847	25
6U/3	JHUNJHUNU	Alsisar	Alsisar	TW	28.31	75.28	7.75	7560	0	1257	1241	1056	160	0.20	3.10	580	40	117	1580	2.68	4914	80
6U/4	JHUNJHUNU	Alsisar	Ghasi ram ka bas	TW	28.29	75.30	8.18	4200	0	1000	610	562	65	0.06	2.92	540	56	97	820	5.24	2730	23
6U/5	JHUNJHUNU	Alsisar	Rampura	TW	28.26	75.31	8.12	5150	0	915	752	540	360	0.10	4.72	500	24	107	1000	3.10	3348	24
6U/6	JHUNJHUNU	Birmi	Rahida stand	TW	28.17	75.23	7.86	1940	0	464	135	269	169	0.05	2.83	190	32	27	370	1.32	1261	12
6U/7	JHUNJHUNU	Birmi	Kabilsar	TW	28.19	75.18	8.42	4830	84	1501	638	130	35	0.45	2.44	200	24	34	1030	2.07	3140	10
6U/8	JHUNJHUNU	Birmi	Birmi	TW	28.18	75.19	7.70	4100	0	1232	553	309	60	0.20	4.03	300	40	49	860	2.38	2665	45
6U/9	JHUNJHUNU	Birmi	HAMIRWAS	TW	28.19	75.15	8.43	4840	120	1403	624	187	34	0.49	2.43	240	24	44	1020	2.07	3146	16
6U/10	JHUNJHUNU	Birmi	Piplani khurd	TW	28.21	75.14	8.26	4400	0	805	851	350	28	0.15	1.42	440	32	88	840	4.22	2860	11
8U/1	CHURU	Churu	BINASAR	TW	28.26	74.88	7.38	5890	0	464	1248	778	57	0.02	0.80	820	72	156	1000	4.15	3829	15.0
8U/2	CHURU	Churu	Churu	NM	28.30	74.93	7.40	4150	0	842	737	328	114	0.65	1.91	230	20	44	890	4.53	2698	65.0
8U/3	CHURU	Rajgarh	DADREWA	TW	28.67	75.23	7.29	800	0	305	71	26	31	0.70	1.70	280	40	44	42	28.5	520	27.0
8U/4	CHURU	Churu	DUDWA KHARA	TW	28.47	75.08	7.47	1920	0	293	369	200	17	0.30	1.27	250	40	36	337	3.53	1248	23.

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																						0
8U/5	CHURU	Sardar Sahar	MELUSAR	TW	28.50	74.74	8.01	8920	0	549	2269	733	454	0.01	2.27	760	64	146	1850	4.70	5798	16.0
8U/6	CHURU	Sardar Sahar	MITTASAR	TW	28.42	74.38	7.90	1260	0	403	163	79	10	0.01	1.37	100	12	17	253	4.28	819	18.0
8U/7	CHURU	Rajgarh	NEEMA	TW	28.47	75.47	8.17	4000	0	927	666	230	234	0.05	3.17	180	20	32	900	2.00	2600	100.0
8U/8	CHURU	RAJGARH	RAJGARH1	NM	28.64	75.37	7.90	3400	0	756	397	78	618	0.30	10.00	480	32	97	600	2.10	2210	170.0
8U/9	CHURU	Churu	RAMPURA	TW	28.47	74.86	6.86	320	0	85	57	12	2.0	0.61	0.03	120	28	12	18	5.07	208	5.0
8U/10	CHURU	Sultanpur	RATTANPURA	DUG WELL	28.53	75.26	7.55	23800	0	305	7374	1397	28	0.01	1.40	4950	980	608	3300	7.96	15470	4.0
8U/11	CHURU	Sardar Sahar	SADASAR	TW	28.70	74.35	7.10	310	0	134	28	8	4.9	0.60	0.50	130	40	7	14	3.33	202	3.0
8U/12	CHURU	Sardar Sahar	SARDARSHAHAR	NM	28.44	74.49	7.98	3000	0	805	362	231	170	0.68	10.30	160	20	27	650	3.14	1950	200.0
8U/13	CHURU	Taranagar	SHAWA	TW	28.88	74.84	7.48	6400	0	537	978	473	1180	0.01	4.00	1320	168	219	800	170	4160	15.0
8U/14	CHURU	Churu	SIRSALA	TW	28.43	75.13	7.66	3000	0	281	525	115	525	0.01	0.26	750	80	134	350	3.13	1950	6.0
8U/15	CHURU	Taranagar	Taranagar	NM	28.69	75.03	6.97	27200	0	195	9050	2332	56	0.01	3.45	6400	800	1070	4140	15.13	17680	14.0
8U/16	HANUMANGARH	Bhadra	Bhadra	NM	29.12	75.16	7.94	3200	0	695	546	207	36	0.01	15.00	270	32	46	620	6.54	2080	494.0
8U/17	HANUMANGARH	Nohar	BHUKARKA	TW	29.23	74.75	7.16	1840	0	732	191	40	67	0.15	0.54	700	68	129	72	86.86	1196	24.0
8U/18	HANUMANGARH	Rawatsar	BISRASAR	TW	28.87	74.28	8.65	700	12	220	43	42	2.1	0.02	0.75	190	16	36	48	58.24	455	21.0
8U/19	HANUMANGARH	Rawatsar	DUDHAL	TW	28.91	74.13	7.74	2190	0	598	170	302	70	0.25	0.72	230	36	34	400	3.50	1424	45.0
8U/20	HANUMANGARH	Bhadra	DUNGRANA	TW	29.01	75.10	7.85	5300	0	1501	596	480	330	0.50	15.60	260	24	49	1200	7.24	3445	140.0
8U/21	HANUMANGARH	Rawatsar	GANDEHALI	TW	29.22	74.53	7.20	4100	0	525	482	590	700	0.41	0.16	940	184	117	440	308.25	2665	5.0

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8U/22	HANUMANGARH	Bhadra	MUNSARI	TW	29.10	75.03	7.33	1800	0	744	206	4	18	0.02	0.18	550	92	78	100	119.34	1170	15.0
8U/23	HANUMANGARH	Rawatsar	PALLU	TW	28.92	74.20	7.10	316	0	110	35	18	4.4	0.01	0.48	120	32	10	18	4.60	205	3.0
8U/24	HANUMANGARH	Rawatsar	PURABSAR	TW	29.03	74.28	7.30	4000	0	110	326	1854	150	0.09	1.50	2100	520	195	230	6.78	2600	14.0
8U/25	HANUMANGARH	Rawatsar	RAWATSAR	NM	29.25	74.41	7.32	5350	0	390	936	358	775	0.23	0.34	1620	328	195	350	203.20	3478	5.0
8U/26	CHURU	Churu	CHURU (Rural)	TW	28.31	74.94	7.35	3200	0	500	666	174	234	0.15	0.65	860	84	158	392.15	8.76	2080	30.0
8U/27	CHURU	Churu	KHERIYA	TW	28.30	74.87	7.00	12000	0	244	2942	1932	21	0.65	0.90	2240	264	384	1900	10.70	7800	4.0
8U/28	CHURU	Churu	GAJSAR	TW	28.31	74.94	7.92	3740	0	854	567	344	135	0.14	0.70	660	64	122	600	5.10	2431	10.0
8U/29	CHURU	Churu	SHYAMPURA	TW	28.27	74.89	7.66	5300	0	805	1078	498	50	0.54	1.78	480	48	88	1040	3.33	3445	65.0
8U/30	CHURU	Churu	SIRSALI	TW	28.46	75.13	7.68	27000	0	439	9075	1514	26	0.01	1.55	2800	220	547	5500	6.33	17550	12.0
8U/31	CHURU	Churu	RAJPURA	TW	28.53	75.14	7.07	136	0	61	7	3	4.0	0.01	0.04	60	16	5	2.4	1.97	88	0.8
8U/32	CHURU	Churu	JAWANIPUR	TW	28.52	75.04	7.78	13000	0	842	2978	952	1000	0.01	2.16	820	72	156	2700	3.90	8450	125.0
8U/33	CHURU	Sardar Sahar	RANASAR BEEKAN	TW	28.32	74.54	7.55	2000	0	500	227	79	350	0.40	2.22	70	12	10	473	3.38	1300	26.0
8U/34	CHURU	Sardar Sahar	ALMORSAR	TW	28.37	74.55	7.82	2500	0	683	305	170	145	0.15	0.60	280	28	51	460	4.75	1625	29.0
8U/35	CHURU	Sardar Sahar	JEEVAN DESAR	TW	28.40	74.53	7.80	2380	0	586	397	50	145	0.25	3.00	130	16	22	500	2.26	1547	24.0
8U/36	CHURU	Rajgarh	REBARI BAS	TW	28.49	75.48	8.35	6380	12	415	553	1650	500	0.15	2.25	480	32	97	1300	3.49	4147	95.0
8U/37	CHURU	Rajgarh	CHANDGOTHI	TW	28.42	75.50	7.50	3050	0	415	723	178	40	0.06	1.12	380	60	56	550	4.12	1983	19.0
8U/38	CHURU	Rajgarh	JASWANTPURA	TW	28.44	75.45	8.06	4900	0	561	978	564	15	0.10	1.68	420	28	85	930	2.65	3185	42.0

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8U/39	CHURU	Sardar Sahar	HARIYASAR GHARSOTAN	TW	28.46	74.49	7.14	350	0	122	35	38	5.7	0.20	0.82	160	40	15	15.68	3.42	228	3.0
8U/40	CHURU	Rajgarh	LUDI JHANDAR	TW	28.66	75.43	7.65	6800	0	744	1319	394	550	0.35	2.00	720	56	141	1200	1.41	4420	45.0
8U/41	CHURU	Sardar Sahar	SAJANSAR	TW	28.37	74.51	7.84	2350	0	671	362	146	28	0.15	2.46	110	24	12	520	1.81	1528	24.0
8U/42	CHURU	Sardar Sahar	UDSAR LODERA	TW	28.42	74.54	7.70	2470	0	488	503	101	20	0.01	1.16	340	52	51	410	3.55	1606	12.0
8U/43	CHURU	Sardar Sahar	BEEKAMSARA	TW	28.45	74.42	7.61	2450	0	354	482	155	115	0.01	0.60	460	88	58	350	4.96	1593	6.0
8U/44	HANUMANGARH	Nohar	NOHAR	DW	29.17	74.76	7.13	1560	0	451	227	110	36	0.01	0.80	400	72	54	172	50.28	1014	4.0
8U/45	CHURU	Rajgarh	GAGOR	TW	28.60	75.34	7.53	21000	0	317	6700	1212	48	0.01	1.58	3400	344	618	3500	6.69	13650	15.0
8U/46	CHURU	Rajgarh	LAMBOR CHHOTI	TW	28.59	75.41	7.93	6500	0	952	1432	346	325	0.01	3.35	820	56	165	1200	2.84	4225	48.0
8U/47	CHURU	Sardar Sahar	MEHRASAR	TW	28.36	74.54	7.70	4025	0	549	794	353	150	0.23	2.00	360	40	63	780	7.72	2616	14.0
9U/1	SIKAR	Fatehpur	Fatehpur	TW	27.98	74.96	7.81	2310	0	817	248	100	125	0.01	0.80	290	36	49	428.55	3.76	1502	64.2
9U/2	CHURU	Ratangarh	Tidiyasar	DW	28.07	74.53	7.72	8250	0	256	2304	702	180	0.25	0.10	1600	208	263	1255	7.65	5363	10.7
9U/3	BIKANER	Lunkaransar	Loderan	TW	28.28	73.91	8.15	2490	0	512	475	140	16	0.15	1.52	170	24	27	493.6	4.66	1619	65.4
9U/4	BIKANER	Lunkaransar	Garabdesar	TW	28.44	74.01	7.54	4420	0	390	1035	125	390	0.22	0.10	530	84	78	776	8.96	2873	29.1
9U/5	BIKANER	Lunkaransar	kaloo	TW	28.39	73.89	7.5	6520	0	366	1879	310	37	0.65	1.40	530	108	63	1269.6	13.33	4238	18.5
9U/6	BIKANER	Lunkaransar	Sahjasar	TW	28.35	73.76	7.74	8830	0	403	2482	720	22	0.45	1.45	1100	68	226	1612.6	7.55	5740	27.6
9U/7	BIKANER	Lunkaransar	Baderan	DW	28.70	73.76	7.72	1620	0	695	121	55	37	0.60	0.65	280	52	36	151.35	173.68	1053	29.6
9U/8	BIKANER	Lunkaransar	Manaria	DW	28.75	73.77	7.89	1520	0	561	170	80	36	0.68	0.25	490	60	83	112.99	59.99	988	32.8

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9U/9	BIKANER	Lunkaransar	Gusaina	TW	27.98	74.95	8.1	7550	0	281	2250	740	5	0.62	0.30	730	152	85	1604.6	6.05	4908	11
9U/10	BIKANER	Bikaner	Arjansar	DW	28.93	73.88	7.91	2450	0	732	284	160	20	0.01	15.00	150	16	27	495.3	2.42	1593	166
9U/11	BIKANER	Lunkaransar	Mahajan	TW	28.77	73.85	8.56	1000	48	293	78	75	6	0.01	1.10	70	20	5	211.25	1.01	650	16. 2
9U/12	BIKANER	Lunkaransar	Malkisar	TW	28.63	73.84	8.29	2450	0	427	376	270	90	0.01	9.10	100	16	15	530.8	1.8	1593	12. 5
9U/13	BIKANER	Lunkaransar	1Lkd	TW	28.60	73.86	7.83	2650	0	171	596	280	70	0.15	3.90	280	44	41	484.9	1.12	1723	29. 19
9U/14	BIKANER	Lunkaransar	Hariasar	TW	28.58	73.81	8.24	1320	0	390	213	10	52	0.02	10.20	90	16	12	268.35	0.88	858	82
9U/15	BIKANER	Lunkaransar	264RD	TW	28.56	73.77	7.38	1680	0	244	248	202	110	0.25	5.25	360	64	49	232.9	1.93	1092	15. 2
9U/16	BIKANER	Kolayat	Jhanjhu	TW	27.81	72.98	7.65	3120	0	415	730	180	3.4	0.50	1.20	360	80	39	550.3	4.42	2028	17. 3
9U/17	BIKANER	Kolayat	Kolayat	TW	27.84	72.96	7.86	2910	0	610	461	265	17	0.41	1.95	400	72	54	478.9	7.4	1892	26. 06
9U/18	BIKANER	Kolayat	Chak Mulajman	TW	27.84	72.90	7.71	4610	0	842	957	225	42	0.23	1.15	330	92	24	902.8	15.17	2997	26
9U/19	BIKANER	Kolayat	Godu(south)	TW	27.98	72.33	8.07	2840	0	634	440	210	36	0.20	9.60	140	28	17	585.4	4.01	1846	140
9U/20	BIKANER	Kolayat	Godu	TW	27.99	72.30	7.49	1320	0	220	361	10	20	0.35	1.20	320	72	34	183.55	5.39	858	7.4
9U/21	BIKANER	Kolayat	Ranjitpura	DW	28.03	72.13	7.7	5420	0	366	993	1200	21	0.15	3.20	120	32	10	1313.5	5.28	3523	62. 5
9U/22	BIKANER	Bikaner	Jalwali	TW	28.24	73.20	7.29	922.4	0	195	78	260	9.00	0.10	0.70	450	92	54	45.04	5.11	600	30. 4
9U/23	BIKANER	Bikaner	Barala	TW	28.33	73.31	7.34	14100	0	244	4538	1020	13	0.69	1.32	150 0	100	304	2835.5	18.1	9165	5.8
9U/24	BIKANER	Bikaner	Lakhusar	TW	28.32	73.19	7.57	9300	0	342	2836	325	150	0.65	3.20	800	184	83	1812	11.89	6045	11. 48
9U/25	BIKANER	Chhattargarh	Sattasar	TW	28.57	73.08	7.46	623.5	0	268	64	210	20	0.01	0.10	380	72	49	70.72	11.63	405	42. 4
9U/26	BIKANER	Chhattargarh	Chhattargarh	TW	28.67	73.13	7.29	990.3	0	207	163	65	36	0.01	0.23	290	28	54	67.26	51.2	644	42. 4
9U/27	BIKANER	Lunkaransar	Raner	TW	28.88	73.29	7.49	4250	0	317	978	370	90	0.23	0.36	580	52	109	696.1	7.65	2763	21.

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																						6
9U/28	BIKANER	Lunkaransar	Lakhansar	TW	28.87	73.35	7.5	5350	0	232	1106	745	350	0.93	0.96	800	84	143	915.2	23.3	3478	20.1
9U/29	BIKANER	Lunkaransar	Kharbaro	TW	28.93	73.41	7.58	747.8	0	244	92	29	9.00	0.25	1.35	160	36	17	93.22	8.7	486	19.9
9U/30	GANGANAGAR	Gharsana	Gharsana	HP	29.03	73.08	7.55	528.2	0	220	57	2	5.00	0.15	0.40	220	48	24	20.04	4.8	343	3.5
9U/31	BIKANER	Khajuwala	Khajuwala	TW	28.69	72.59	7.11	358.4	0	134	64	5	4.00	0.22	0.41	140	36	12	30	6.2	233	3.4
9U/32	BIKANER	Lunkaransar	Kasturia	TW	28.33	73.49	8.17	920	0	302	92	30	21	0.65	5.10	50	8	7	180	1.96	598	54.7
9U/33	BIKANER	Lunkaransar	Sangrew	TW	28.70	73.88	8.4	2080	48	415	269	180	42	0.01	6.50	120	12	22	425	2.3	1352	3.7
9U/34	BIKANER	Lunkaransar	Khirera	DW	28.48	73.56	7.04	944.4	0	195	50	65	210	0.60	0.45	300	48	44	79.4	1.52	614	8.2
9U/35	BIKANER	Lunkaransar	Binjawari	DW	28.46	73.46	7.54	697.6	0	220	92	2	60	0.68	0.68	300	40	49	28.63	2.3	453	3.89
9U/36	BIKANER	Bikaner	Kelan	TW	28.47	73.25	7.28	9960	0	207	3620	40	30	0.65	0.40	1600	268	226	1717.4	16.2	6474	2.4
9U/37	BIKANER	Deshnok	Parwa	TW	27.72	73.38	7.39	3040	0	293	808	210	70	0.22	0.15	650	144	71	457.5	10.38	1976	17.1
9U/38	BIKANER	Nokha	Nokha	TW	27.55	73.47	7.5	6120	0	281	1312	980	26	0.62	1.01	1550	364	156	731.2	7.2	3978	15.6
9U/39	BIKANER	Panchoo	Panchoo	TW	27.51	73.21	7.78	2110	0	439	404	65	110	0.01	0.42	370	64	51	329.25	3.67	1372	17.4
9U/40	CHURU	Bidasar	Bamboo	DW	27.73	74.12	7.02	3120	0	134	978	65	10	0.15	0.30	550	152	41	464.1	6.53	2028	8.9
9U/41	CHURU	Sujangarh	Bidasar	DW	27.84	74.28	7.58	3860	0	464	752	190	380	0.02	0.55	1090	132	185	392.4	6.51	2509	1.8
9U/42	CHURU	Sujjangarh	Guleriya	DW	27.74	74.42	7.08	1850	0	388	370	30	60	0.25	1.19	340	96	24	254.75	25.3	1203	4.3
9U/43	CHURU	Sujangarh	Sujangarh	TW	27.71	74.48	7.96	10330	0	1086	2411	202	720	0.65	17.10	450	44	83	2158	10.74	6715	551
9U/44	CHURU	Ratangarh	Parihara	TW	27.92	74.56	7.83	18500	0	561	4560	4050	300	0.62	1.40	1050	88	202	4745	10.41	12025	12.6
9U/45	CHURU	Ratangarh	Ratangarh	TW	28.06	74.60	7.73	3280	0	329	652	135	390	0.22	1.25	390	72	51	570	17.46	2132	13.4

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9U/46	SIKAR	Laxmangarh	Laxmangarh	TW	27.84	75.02	7.67	1420	0	351	191	65	110	0.21	1.22	170	40	17	252.8	2	923	25.4
9U/47	SIKAR	Khandela	Khandela	TW	27.60	75.50	7.56	1960	0	537	305	60	10	0.23	2.80	440	80	58	238.8	7.32	1274	22.8
9U/48	SIKAR	DantaRamgarh	Ramgarh	TW	27.26	75.18	7.4	3150	0	312	820	55	190	0.11	1.10	560	116	66	488.1	2.63	2048	6.38
11U/1	AJMER	Peesangan	TABIJI	dug well	26.36	74.62	7.81	5660	0	842	1092	561	15	0.25	1.02	600	68	105	1021	8.3	3679	20.0
11U/2	AJMER	Peesangan	Mangaliyawas	HP	26.28	74.51	7.89	2080	0	195	347	360	15	0.17	1.53	250	12	54	362	4	1352	20.0
11U/3	AJMER	Peesangan	LAMANA	dug well	26.23	74.49	7.15	575	0	195	35	64	11	1.13	0.17	210	40	27	33	4.9	374	16.5
11U/4	AJMER	Jawaja	NARBADKHERA	HP	26.05	74.28	7.39	4120	0	586	992	108	80	0.54	0.77	800	72	151	569	18	2678	10.0
11U/5	AJMER	Srinagar	KANPURA1	HP	26.40	74.87	7.78	9740	0	1391	2162	440	250	0.15	2.53	750	160	85	1872	40	6331	6.5
11U/6	AJMER	Masuda	MASUDA1	HP	26.09	74.51	7.64	820	0	220	106	58	13	0.47	2.25	220	44	27	82	10	533	7.6
11U/7	AJMER	Masuda	LUDIYANA	HP	26.09	74.50	7.81	6620	0	325	737	1486	556	0.37	2.50	800	120	122	1123	56	4303	13
11U/8	AJMER	Masuda	JHOPADIYAN	HP	26.09	74.50	7.55	1680	0	390	184	163	110	0.10	0.55	420	24	88	192	5.1	1092	13
11U/9	AJMER	Jawaja	BAGLIAS	dug well	26.09	74.50	7.62	2040	0	586	213	220	4.7	0.04	1.60	300	40	49	328	6.9	1326	16
11U/10	AJMER	Jawaja	TARAGARH	HP	25.88	74.15	7.4	830	0	305	50	77	13	0.07	1.37	220	20	41	88	6.1	540	11
11U/11	AJMER	Jawaja	MAIDAYABADAYA	dug well	26.12	74.37	7.6	2920	0	366	538	383	0	0.20	0.71	630	140	68	377	11	1898	10
11U/12	BHILWARA	Asind	BADNOR	HP	25.83	74.28	7.49	2050	0	439	304	204	27	0.09	0.50	430	80	56	245	50	1333	4
11U/13	RAJSAMAND	Bhim	GHATA	HP	25.78	74.18	7.61	1050	0	293	106	124	1.3	0.11	1.78	320	44	51	94	2.7	683	23
11U/14	BHILWARA	ASIND	ASIND	HP	25.73	74.33	7.95	5460	0	939	801	764	26	0.11	3.72	800	80	146	879	15	3549	120
11U/15	BHILWARA	Shahpura	KANCHAN-KALA	dug well	25.76	74.91	7.92	480	0	61	78	74	1.2	0.09	0.02	170	32	22	31	3.7	312	12
11U/16	BHILWARA	Jahazpur	BORANI	dug well	25.68	75.33	7.52	4050	0	622	439	745	145	0.02	0.63	1000	128	165	469	5.1	2633	10
11U/17	BHILWARA	Kotri	PAROLI	dug well	25.52	75.09	7.7	740	0	134	92	122	1.1	0.07	0.74	240	48	29	60	2	481	12

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11U/18	BHILWARA	Kotri	Bhagwanpura	dug well	25.47	75.06	7.48	1140	0	500	64	17	62	1.10	0.57	370	88	36	84	16	741	8
11U/19	BHILWARA	Banera	RAILA ROAD	dug well	25.63	74.60	8.08	3790	0	610	539	342	337	0.09	2.28	520	48	97	632	3.4	2464	20
11U/20	BHILWARA	hurda	hurda	HP	25.90	74.69	7.94	1800	0	220	364	195	1.5	0.18	0.70	360	32	68	248	4.1	1170	7
11U/21	BHILWARA	Hurda	GULABPURA	dug well	25.90	74.67	7.66	9380	0	781	2446	540	44	0.26	0.24	1350	220	195	1486	87	6097	25
11U/22	AJMER	Arain	SARWAD	dug well	26.05	75.00	7.78	3820	0	707	603	402	70	0.17	1.34	390	80	46	695	9.2	2483	8
11U/23	AJMER	Kekri	BOGLA	HP	25.89	75.23	7.77	935	0	244	142	50	2.1	0.09	5.00	270	44	39	90	3.3	608	10
11U/24	AJMER	Arain	Barora	dug well	26.21	75.04	7.98	3740	0	976	567	86	217	0.11	1.05	340	40	58	695	15	2431	4
11U/25	JAIPUR	Sambher	Sambhar	dug well	26.91	75.22	7.94	2120	0	366	362	132	136	0.12	0.37	440	96	49	281	8.2	1378	2
11U/26	JAIPUR	Sambher	Sambhar	HP	26.90	75.20	8.1	5830	0	1305	1021	202	220	0.04	6.30	660	88	107	1037	2.4	3790	1
11U/27	JAIPUR	Sambher	Sambhar	HP	26.89	75.22	7.83	3260	0	567	650	122	143	0.02	2.43	300	40	49	612	2.5	2119	2
11U/28	JAIPUR	Sambher	Sambhar	HP	26.93	75.23	7.79	3700	0	671	545	302	266	0.01	0.19	980	112	170	399	3.5	2405	1
11U/29	JAIPUR	Phagi	Majhi Renwal	dug well	26.70	75.68	7.83	4650	0	988	609	506	148	0.31	2.32	1450	100	292	399	6.3	3023	150
11U/30	JAIPUR	Dudu	NASNOTA	HP	26.80	75.44	7.67	9810	0	769	2588	526	86	0.06	2.09	450	60	73	2045	9.5	6377	10
11U/31	JAIPUR	Dudu	PALLUKHURD	dug well	26.74	75.33	7.62	3110	0	732	560	110	48	0.01	4.31	400	60	61	529	5.4	2022	0
11U/32	JAIPUR	Dudu	MANGARWARA	dug well	26.61	75.28	7.41	760	0	183	92	92	4.3	0.23	0.04	270	40	41	49	4.4	494	5
11U/33	JAIPUR	Dudu	MOZMABAD	dug well	26.68	75.36	7.42	14700	0	488	4502	562	8.3	0.27	1.76	1550	300	195	2669	9.4	9555	41
11U/34	JAIPUR	Phagi	Chittora	HP	26.64	75.70	7.72	4010	0	671	851	162	103	0.01	1.04	800	80	146	552	5.4	2607	35
11U/35	JAIPUR	Phagi	Bhojpura	dug well	26.62	75.61	8.17	3850	0	964	567	288	31	0.07	3.45	270	28	49	761	2.5	2503	22
11U/36	JAIPUR	Phagi	Ladana	dug well	26.65	75.59	7.78	1390	0	397	213	52	13	0.03	1.27	380	24	78	143	4.7	904	15
11U/37	JAIPUR	Phagi	Tickel	HP	26.71	75.50	7.49	2290	0	403	482	120	10	0.11	0.01	460	88	58	306	16	1489	20
11U/38	JAIPUR	Phagi	Chakwara	HP	26.61	75.51	8.01	5330	0	1500	794	288	11	0.14	2.05	440	24	92	1017	12	3465	45
11U/39	JAIPUR	Phagi	Choru	dug well	26.59	75.45	7.88	1120	0	207	206	92	1.6	0.16	0.61	320	56	44	106	8.5	728	15

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11U/40	JAIPUR	Phagi	Lasariya	HP	26.56	75.51	7.67	9600	0	427	2127	1274	143	0.17	4.34	1600	100	328	1472	7	6240	20
11U/41	JAIPUR	Phagi	Madhorajpur	HP	26.58	75.66	7.92	4500	0	1025	723	304	79	0.09	4.50	280	54	35	906	4.8	2925	12
11U/42	JAIPUR	Phagi	DAWACH	dug well	26.57	75.75	7.61	4010	0	769	613	468	19	0.04	1.91	460	52	80	681	52	2607	10
11U/43	JAIPUR	Phagi	DAWACH	HP	26.57	75.76	8.2	1410	0	549	135	41	12	0.03	4.01	60	12	7	294	4.8	917	2
11U/44	JAIPUR	Phagi	DAWACH	HP	26.56	75.76	8.07	6960	0	597	1205	1222	6.1	0.05	4.94	620	80	102	1313	7.2	4524	5
11U/45	JAIPUR	Chaksu	Tootoli	HP	26.63	75.80	8.06	4325	0	1025	723	268	17	0.21	3.36	360	48	58	827	5.7	2811	25
12U/1	BANSWARA	Garhi	Arthuna1	PZ	23.50	74.10	7.10	840	0	207	78	94	50	0.01	0.60	250	64	22	78	1.77	546	1
12U/2	BANSWARA	Bagidora	Bagidora	Dug	23.40	74.27	7.51	690	0	220	43	92	1.5	0.01	2.13	150	20	24	88	3.1	449	9
12U/3	BANSWARA	Banswara	Banswara1	Dug	23.53	74.45	7.50	1080	0	268	85	158	34	0.01	1.95	310	40	51	105	1.16	702	8
12U/4	BANSWARA	Bagidora	Barodiya	Dug	23.42	74.35	7.77	884	0	232	71	120	27	0.01	0.40	180	32	24	115	8.5	575	5
12U/5	BANSWARA	Banswara	Borwat	PZ	23.51	74.38	7.76	850	0	427	28	9	30	0.01	1.37	210	16	41	100	0.55	553	7
12U/6	BANSWARA	Kushalgarh	Charakni	Dug	23.31	74.38	7.75	1680	0	671	121	60	70	0.01	3.00	180	16	34	306	3.0	1092	9
12U/7	BANSWARA	Anandpuri	CHHAJA	PZ	23.43	74.06	7.55	985	0	305	78	108	24	0.01	0.40	230	44	29	95	44.7	640	BDL
12U/8	BANSWARA	Sajjangarh	CHOTA DUNGRA	Dug	23.17	74.29	7.65	970	0	366	57	45	65	0.01	1.83	280	28	51	94	0.84	631	1
12U/9	BANSWARA	Gangartalai	Gangar Talai	H.P.	23.26	74.17	6.70	940	0	220	85	104	75	0.01	0.63	280	60	32	87	1.93	611	BDL
12U/10	BANSWARA	Ghatol	GANORA	Dug	23.77	74.25	7.68	1770	0	342	220	208	95	0.01	0.44	390	92	39	220	14	1151	4
12U/11	BANSWARA	Sajjangarh	Kharod Chatra	NM	23.22	74.29	7.45	440	0	232	14	2	16	0.01	0.62	170	56	7	26	0.71	286	BDL
12U/12	BANSWARA	Sajjangarh	Maudi Maska	NM	23.15	74.31	7.77	1610	0	378	184	139	100	0.01	2.90	260	32	44	250	1.45	1047	5
12U/13	BANSWARA	Banswara	Padla Barora	Dug	23.54	74.52	7.78	1040	0	403	50	24	110	0.01	2.50	190	20	34	152	1.95	676	10
12U/14	BANSWARA	Sajjangarh	Samla Sahar	NM	23.21	74.25	7.71	1050	0	244	64	132	115	0.01	1.00	300	32	54	100	6.46	683	1
12U/15	CHITTAURGARH	Dungla	Mahuda	Dug	24.36	74.35	7.84	590	0	293	35	1	10	0.04	1.50	140	24	19	75	0.88	384	8
12U/16	DUNGARPUR	Simalwara	KUA	Dug	23.47	73.91	7.25	926	0	220	78	150	17	0.02	0.43	220	32	34	110	3.14	602	4
12U/17	DUNGARPUR	Bichhiwara	NAVAL SHYAM	PZ	23.84	73.57	7.48	1100	0	281	163	82	2.4	0.05	0.56	180	28	27	150	34	715	2

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12U/18	DUNGARPUR	Bichhiwara	NAYADERA	Dug	23.83	73.68	7.32	1610	0	268	248	198	26	0.02	0.60	320	60	41	220	2.68	1047	3
12U/19	DUNGARPUR	Aspur	Ramgarh2	Dug	23.93	73.97	7.78	1070	0	317	99	110	16	0.01	2.32	360	48	58	80	1.83	696	6
12U/20	PRATAPGARH	Arnod	Arnod_Pz	Pz	23.90	74.81	7.48	2190	0	244	447	214	55	0.01	0.50	620	80	102	220	2.26	1424	2
12U/21	PRATAPGARH	Chhotisadri	Choti Sadri	Dug	24.39	74.70	7.78	1050	0	293	64	142	52	0.01	1.80	260	44	36	122	1.21	683	3
12U/22	PRATAPGARH	Pratapgarh	Datla Kund	NM	23.96	74.72	7.70	540	0	220	35	20	22	0.03	0.10	180	36	22	41	1.50	351	1
12U/23	PRATAPGARH	Arnod	Moheda	Dug	23.78	74.86	7.34	2070	0	98	475	223	60	0.01	0.32	640	168	54	180	1.18	1346	2
12U/24	PRATAPGARH	Pratapgarh	Mokhampura	Dug	24.02	74.88	7.63	1170	0	317	128	53	115	0.01	0.46	470	76	68	55	0.48	761	5
12U/25	PRATAPGARH	Dhariyawad	Mungana	Dug	23.96	74.43	7.58	1200	0	403	121	37	74	0.35	0.42	430	48	75	73	10.18	780	2
12U/26	PRATAPGARH	Peepalkhoont	Peepalkhoont	Dug	23.80	74.57	7.58	1000	0	244	85	82	130	0.01	0.26	450	68	68	28	1.13	650	BDL
12U/27	UDAIPUR	Lasadiya	ARAMPUR	Dug	24.25	74.42	8.12	1410	0	439	199	65	3	0.01	0.74	250	16	51	210	5.42	917	4
12U/28	UDAIPUR	Jhadol	Ghori Mari	Dug	24.31	73.39	7.40	880	0	256	99	48	44	0.02	0.68	270	36	44	75	5.67	572	BDL
12U/29	UDAIPUR	JHADOL	JHADOL	H.P.	24.41	73.50	7.76	2040	0	464	284	165	85	0.04	0.46	630	72	109	118	107	1326	8
12U/30	UDAIPUR	Rishabhdeo	KALAYANPURA	Dug	24.00	73.76	7.90	1350	0	415	128	105	60	0.01	0.92	320	60	41	112	92	878	3
12U/31	UDAIPUR	LASADIYA	LASADIYA	H.P.	24.27	74.24	7.69	970	0	293	85	115	2	0.02	0.76	280	28	51	90	8.2	631	10
12U/32	UDAIPUR	Sarada	SEMARI	Dug	24.06	73.85	7.84	1600	0	659	135	32	45	0.01	3.32	230	16	46	260	11.11	1040	20
17U/1	DAUSA	Dausa	Dausa1	Handpump	26.90	76.33	8.25	3020	0	647	390	352	73	0.04	1.33	230	40	32	588	5.4	1963	36
17U/2	DAUSA	Dausa	Bapi	Handpump	26.98	76.29	7.79	5450	0	488	1460	229	28	0.07	1.73	1040	104	189	771	10	3543	29
17U/3	ALWAR	Rajgarh	Todi Ka Bas	BW	27.12	76.33	7.26	1570	0	256	269	134	61	0.20	0.96	410	116	29	170	4.5	1021	7.3
17U/4	DAUSA	Dausa	Jasuta HS 1	Handpump	26.97	76.32	7.67	5700	0	671	922	947	16	0.09	0.10	1400	120	267	677	8.6	3705	8.7
17U/5	DAUSA	Dausa	Jasuta HS 2	Handpump	26.97	76.33	7.14	10410	0	732	2410	537	794	0.11	0.57	1950	400	231	1480	67	6767	86
17U/6	DAUSA	Dausa	Jasuta HS 3	Handpump	26.96	76.33	7.97	2680	0	732	241	369	6.4	0.11	3.59	330	40	56	459	10	1742	40
17U/7	DAUSA	Dausa	Jasuta HS 4	Handpump	26.96	76.32	7.95	4510	0	549	851	569	10	0.09	1.07	440	88	53	792	74	2932	12
17U/8	BHARATPUR	Weir	Weir	Handpump	27.02	77.17	8.17	1690	0	610	134	128	29	0.02	1.43	330	32	61	241	1.3	1099	11

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17U/9	BHARATPUR	Bayana	Bhagori_Dw	Dug	26.97	77.25	7.45	780	0	171	106	84	11	0.07	1.42	260	28	46	58	3.9	507	0.06
17U/10	BHARATPUR	Bayana	Kheria Mod	Handpump	26.95	77.38	8.33	1520	12	390	85	297	5	1.10	2.37	90	24	7	308	1.6	988	59
17U/11	BHARATPUR	Nadbai	Nadbai HS	BW	27.23	77.19	7.78	2380	0	781	234	174	43	0.09	1.57	250	40	36	433	2.3	1547	65
17U/12	BHARATPUR	Nadbai	Nadbai HS1	Handpump	27.23	77.19	7.8	6700	0	878	942	1248	1.8	0.18	0.18	750	124	107	1196	3.8	4355	15
17U/13	BHARATPUR	Deeg	Mandhera	Handpump	27.40	77.35	7.48	4000	0	537	851	218	156	0.26	2.05	1540	360	155	206	11	2600	25
17U/14	BHARATPUR	Kaman	Kaman	Handpump	27.66	77.27	7.52	7300	0	561	1172	1456	20	0.17	1.83	1240	200	180	1002	200	4745	23
17U/15	BHARATPUR	Deeg	Deeg1	BW	27.47	77.33	7.5	720	0	244	92	24	4	0.09	1.65	185	36	23	76	10	468	1.5
17U/16	BHARATPUR	Nagar	Nagar	Handpump	27.43	77.10	8.23	5600	0	1135	652	883	37	0.11	2.50	280	40	44	1153	12	3640	135
17U/17	BHARATPUR	Nagar	Gopalgarh HS	BW	27.65	77.07	7.77	9420	0	671	2179	1038	8.6	0.12	0.16	960	108	168	1738	7.2	6123	5.2
17U/18	BHARATPUR	Nagar	Pahari	Dug	27.70	77.09	8.04	6490	0	915	1064	940	20	0.04	0.82	260	40	39	1380	2.4	4219	65
17U/19	BHARATPUR	Nagar	Gopalgarh HS1	BW	27.66	77.07	8.14	4600	0	964	797	355	27	0.02	0.56	260	32	44	938	10	2990	51
17U/20	ALWAR	Lachhmangarh	Lachmangarh	Dug	27.35	76.86	7.69	8300	0	720	1843	920	7.6	0.01	0.32	2060	240	354	964	2.2	5395	33
17U/21	ALWAR	Kathumar	Kathumar	BW	27.32	77.08	8.02	4970	0	549	852	762	47	0.31	0.54	600	80	97	868	2.7	3231	5.63
17U/22	ALWAR	Reni	Reni	H.P.	27.18	76.74	8.25	2920	0	824	382	226	5.4	0.06	1.75	230	32	36	565	3.1	1898	14
17U/23	DAUSA	Bandikui	Bandikui	BW	27.30	76.57	7.69	2500	0	390	453	156	165	0.01	0.09	640	96	97	282	4.2	1625	3.6
17U/24	BHARATPUR	Sewar	Chiksana	Dug	27.18	78.10	7.77	3150	0	464	645	270	1.3	0.23	0.38	530	104	66	476	9	2048	1.6
17U/25	BHARATPUR	Sewar	Sewar	D.W.	27.00	77.44	7.68	6030	0	537	1418	514	46	0.27	0.23	1220	160	199	832	5.1	3920	6.1
17U/26	BHARATPUR	Sewar	Ludhawai_Gwd	Dug	27.18	77.40	7.78	5400	0	686	1276	307	26	0.01	0.58	960	136	151	803	1.3	3510	6.4
17U/27	BHARATPUR	Roopwas	Khanua	Handpump	27.03	77.55	7.08	3015	0	256	637	327	72	0.07	0.01	670	116	92	381	10	1960	28
17U/28	BHARATPUR	Roopwas	Roopwas	H.P	26.00	77.59	7.7	2660	0	598	304	291	129	0.03	0.97	270	52	34	258	392	1729	3
17U/29	BHARATPUR	Roopwas	Dahinagaon	Handpump	27.00	77.49	7.52	1880	0	293	284	192	120	0.11	0.31	500	64	83	182	36	1222	4.5

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17U/30	DAUSA	Mahua	Khedla	Dug	26.00	76.98	7.91	940	0	207	71	38	196	0.14	1.11	260	24	49	92	9.2	611	6.3
17U/31	DAUSA	Mahua	Higetawari Dhani	Dug	26.90	77.03	8.05	4420	0	598	765	602	11	0.16	1.31	270	40	41	892	1.9	2873	16
17U/32	KARAULI	Hindaun	Hindaun	BW	26.75	77.03	7.97	3670	0	610	553	518	14	0.17	1.52	330	52	49	692	3.8	2386	9.4
17U/33	KARAULI	Hindaun	Hindaun HS	BW	26.73	77.03	7.81	4340	0	964	674	98	398	0.09	1.12	690	100	107	680	1.8	2821	11
17U/34	KARAULI	Hindaun	Islampur	Dug	26.70	77.02	8.02	4540	0	988	767	264	114	0.04	3.90	230	32	36	937	2.6	2951	29
17U/35	DAULPUR	Dhaulpur	Kanthri	Dug	26.86	77.72	7.91	880	0	281	71	82	25	0.03	0.36	285	40	45	69	4	572	0.37
17U/36	DAULPUR	Saipau	Saipau	Dug	26.82	77.75	8.04	1400	0	488	106	115	28	0.05	2.82	170	24	27	244	1	910	15
17U/37	DAULPUR	Dhaulpur	Aathmeel	Handpump	26.65	77.80	7.73	790	0	244	99	34	20	0.21	0.70	210	36	29	84	2.7	514	4.1
17U/38	DAULPUR	Bari	Bari1	Dug	26.65	77.61	7.74	1095	0	232	85	222	4	0.01	0.32	290	40	46	118	1.2	712	3.2
17U/39	DAULPUR	Rajakhera	Rajakhera	T.W.	26.00	78.17	7.79	2530	0	366	470	286	2.6	0.01	0.66	360	40	63	414	4.9	1645	7
17U/40	DAULPUR	Baseri	Angai	Dug	26.61	77.47	7.66	1145	0	366	134	53	35	0.01	0.01	285	44	42	98	59	744	7.7
17U/41	KARAULI	Karauli	Bhauapura HS1	Dug	26.00	77.18	7.59	1790	0	195	376	194	0.21	0.01	0.90	280	40	44	282	4.7	1163.5	86
17U/42	KARAULI	Karauli	Bhauapura	Dug	26.54	77.18	7.67	1440	0	342	213	81	63	0.01	0.83	250	64	22	207	18	936	7.34
17U/43	KARAULI	Karauli	Bhauapura HS2	Dug	26.00	77.18	7.93	1200	0	268	199	91	0.42	0.01	1.27	205	32	30	180	4	780	3.1
17U/44	KARAULI	Hindaun	Badh Kamla	BW	26.69	76.93	7.75	3160	0	573	461	340	128	0.01	1.05	540	80	83	457	38	2054	16
17U/45	KARAULI	Karauli	Karsai	Dug	26.43	76.93	6.98	5450	0	122	1134	927	73	0.01	0.15	1820	360	223	414	5.2	3542.5	20
17U/46	KARAULI	Sapotra	Sapotra1	BW	26.28	76.77	7.42	2300	0	427	298	240	159	0.01	0.20	350	80	36	274	162	1495	12
17U/47	SAWAI MADHOPUR	Bamanwas	Bamnawas	Handpump	26.00	76.56	7.89	8300	0	939	1617	1045	7.6	0.01	2.05	540	72	87	1661	2.8	5395	12
17U/48	KARAULI	Nadauti	Sahar1	Dug	26.61	76.71	7.62	7000	0	244	1602	996	1.39	0.01	0.42	1200	272	126	1053	10	4550	42
17U/49	KARAULI	Karauli	Karauli	BW	26.50	77.02	7.92	1650	0	366	213	144	89	0.01	0.14	550	80	85	126	2.3	1072.5	3.6
17U/50	ALWAR	Thanagazi	Kalighati Sariska	Handpump	27.31	76.41	7.62	710	0	329	21	43	11	0.01	0.99	280	28	51	34	4.4	461.5	1.8
17U/51	ALWAR	Rajgarh	Tehla	Handpump	27.24	76.40	7.67	2460	0	317	368	341	113	0.01	0.53	570	96	80	299	8.8	1599	13

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20U/1	BARAN	Kishanganj	BHANWARGARH	TW	25.09	76.79	7.11	650	0	171	35	70	70	0.04	1.30	230	48	27	42	2.41	423	5
20U/2	BARAN	Chhabra	Chhabra_GWD	TW	24.67	76.84	7.48	1050	0	207	113	149	46	0.02	1.18	350	40	61	81	0.80	683	3
20U/3	BARAN	Chhipabarod	CHHIPA BAROD	TW	24.59	76.73	7.38	1330	0	329	121	160	72	0.05	0.92	340	40	58	148	5.51	865	1
20U/4	BARAN	Chhipabarod	HARNAUDA	TW	24.44	76.70	7.36	1390	0	146	135	367	22	0.02	1.14	660	172	56	25	0.15	904	1
20U/5	BARAN	Shahabad	Kasba Thana	HP	25.21	77.36	7.70	530	0	195	21	53	20	0.01	0.90	180	32	24	39	0.32	345	BDL
20U/6	BUNDI	Talera	BALLOP	HP	25.52	76.17	7.46	940	0	232	71	157	16	0.01	1.22	280	36	46	87	2.57	611	4
20U/7	BUNDI	Keshorai Patan	Dahi Khera	HP	25.47	75.87	7.84	2450	0	793	369	118	2.1	0.01	0.72	820	16	190	218	2.49	1593	10
20U/8	BUNDI	Bundi	DELUNDA	HP	25.54	76.00	7.87	960	0	439	43	32	22	0.03	3.15	110	16	17	170	0.97	624	29
20U/9	BUNDI	Keshorai Patan	GAINDOLI	DW	25.39	76.07	7.65	820	0	281	85	60	3.5	0.01	0.98	250	36	39	77	2.31	533	6
20U/10	BUNDI	Keshorai Patan	KAPREN	DW	25.32	75.93	7.80	3220	0	586	737	195	2.0	0.01	0.74	360	28	71	625	8.35	2093	7
20U/11	BUNDI	Keshorai Patan	KESHORAIPATAN	DW	25.67	76.18	7.71	2780	0	464	397	462	1.4	0.35	1.64	500	16	112	427	0.52	1807	5
20U/12	BUNDI	Keshorai Patan	LAKHERI	HP	25.41	75.89	7.87	2610	0	281	383	542	2.6	0.01	1.18	390	44	68	436	3.14	1697	BDL
20U/13	BUNDI	Keshorai Patan	MAIJA	DW	25.49	75.79	8.12	1200	0	549	113	36	1.0	0.01	1.82	240	20	46	190	0.77	780	14
20U/14	BUNDI	Hindoli	SATUR	HP	25.48	75.56	7.55	1540	0	281	149	218	129	0.02	1.20	340	72	39	148	89.5	1001	2
20U/15	JAIPUR	Phagi	Didawata	HP	26.49	75.73	7.93	1675	0	403	149	166	155	0.04	1.88	310	20	63	200	77.5	1089	11
20U/16	JAIPUR	Phagi	Didawata (Near PZ)	HP	26.49	75.73	8.07	1290	0	598	78	24	53	0.01	3.15	270	12	58	184	5.82	839	30
20U/17	JAIPUR	Phagi	Didawata (Sedriya)	HP	26.49	75.73	7.74	3100	0	537	567	178	150	0.02	1.90	370	16	80	540	6.75	2015	14
20U/18	JAIPUR	Phagi	Didawata	HP	26.49	75.73	7.00	1560	0	134	277	202	85	0.01	0.64	540	120	58	106	8.60	1014	14
20U/19	JAIPUR	Phagi	Nemeda	HP	26.50	75.51	7.40	2300	0	207	411	240	190	0.01	0.80	700	164	71	210	1.09	1495	6
20U/20	JAIPUR	Phagi	Parun	HP	26.51	75.61	7.61	1560	0	329	220	167	46	0.01	1.04	320	28	61	212	11.30	1014	5
20U/21	JHALAWAR	Manohar Thana	AKLERA	HP	24.41	76.56	7.12	1580	0	207	277	186	41	0.01	0.45	380	48	63	186	4.77	1027	9
20U/22	JHALAWAR	Jhalara Patan	AKTASA	HP	24.49	76.30	7.58	1040	0	305	99	91	17	0.01	1.08	330	32	61	78	1.78	676	1

Lab Id	District	Block	Location	Aqui- fer	Lat.	Long.	pH	EC(µS/cm at 25 deg.cel)	CO3 mg/l	HCO 3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	PO4 mg/l	F mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	TDS mg/l	U mg /l
20U/23	JHALAWAR	Bakani	ASALPUR	HP	24.27	76.50	8.20	760	0	403	35	36	19	0.01	0.70	50	8	7	176	2.71	494	BDL
20U/24	JHALAWAR	Jhalara Patan	BINDA	HP	24.41	76.19	7.45	920	0	146	121	128	33	0.01	0.52	300	76	27	70	1.00	598	BDL
20U/25	JHALAWAR	Dag	DAG1	DW	23.95	75.83	7.40	1040	0	159	184	108	17	0.02	1.30	180	36	22	156	1.05	676	BDL
20U/26	JHALAWAR	Jhalara Patan	GAGRON	HP	24.66	76.19	7.87	1780	0	415	255	145	0.49	0.15	0.66	280	68	27	261	7	1157	BDL
20U/27	JHALAWAR	Manohar Thana	GAJWARA	DW	24.34	76.77	7.21	980	0	183	135	93	65	0.04	0.52	340	68	41	70	0.53	637	BDL
20U/28	JHALAWAR	Dag	GUNAVI	TW	24.00	75.88	7.46	1530	0	134	262	178	120	0.01	0.66	330	92	24	200	0.60	995	BDL
20U/29	JHALAWAR	Jhalara Patan	GURARIYA JOGA	HP	24.37	75.84	7.67	1420	0	354	142	122	110	0.01	0.92	480	32	97	106	0.51	923	BDL
20U/30	JHALAWAR	Dag	KARVAN KALA	DW	24.60	76.26	7.45	1400	0	183	291	114	21	0.01	3.50	180	36	22	240	3.63	910	7
20U/31	JHALAWAR	Jhalara Patan	MANDAWAR1	TW	24.23	76.81	7.02	440	0	207	50	5	0.65	0.02	0.50	170	40	17	17	35	286	BDL
20U/32	JHALAWAR	Manohar Thana	SAREDI	DW	24.35	76.67	7.62	1450	0	354	99	84	165	0.01	0.52	540	40	107	36	27.40	943	BDL
20U/33	KOTA		SULTANPUR	HP	25.45	76.43	7.55	1920	0	415	156	370	14	0.01	0.64	250	24	46	326	2.58	1248	9
20U/34	SAWAI MADHOPUR	Bonli	BHADOTI	TW	25.97	76.27	7.73	2765	0	427	390	357	143	0.01	1.78	490	28	102	410	10.0	1797	11
20U/35	SAWAI MADHOPUR	Sawai Madhopur	KUSHTALA	HP	26.31	76.38	8.00	930	0	134	220	20	17	0.03	1.68	220	32	34	34	110	605	BDL
20U/36	SAWAI MADHOPUR	Bonli	MALARNACHOR	HP	26.02	76.46	7.90	570	0	220	35	48	3.0	0.01	0.74	170	24	27	52	1.94	371	1
20U/37	SAWAI MADHOPUR	Sawai Madhopur	RANTHAMBOR	HP	26.09	76.36	7.41	1600	0	317	260	102	135	0.08	0.54	490	72	75	135	48	1040	BDL
20U/38	SAWAI MADHOPUR	Sawai Madhopur	SURWAL	HP	26.37	76.40	7.39	1380	0	244	184	180	50	0.09	0.48	310	60	39	155	39	897	BDL
20U/39	SAWAI MADHOPUR	Bonli	TOND1	HP	25.97	76.08	7.41	7250	0	390	2269	253	60	0.01	2.30	1300	56	282	1080	150.0	4713	5
20U/40	SAWAI MADHOPUR	Bonli	TOND2	HP	26.37	76.38	7.80	1150	0	464	121	70	0.22	0.01	1.24	300	16	63	150	1.80	748	10
20U/41	SAWAI MADHOPUR	Bonli	TOND (Infront of Canara Bank)	HP	26.37	76.38	7.79	3950	0	878	574	432	200	0.01	1.35	280	12	61	857	3.72	2568	70

Lab Id	District	Block	Location	Aqui- fer	Lat.	Long.	pH	EC(µS/cm at 25 deg.cel)	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	PO4 mg/l	F mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	TDS mg/l	U mg/l
20U/42	SAWAI MADHOPUR	Bonli	TOND (1km towards Lalsot)	HP	26.37	76.38	8.18	2790	0	1220	191	194	15	0.01	2.22	140	8	29	620	3.10	1814	75
20U/43	SAWAI MADHOPUR	Bonli	TOND (1km towards Sawai Madhopur)	HP	26.37	76.38	8.21	2890	0	1415	191	218	3.6	0.02	1.50	140	20	22	700	3.53	1879	60
20U/44	TONK	TONK	TONK (Near Romji Garments)	TW	26.35	76.25	7.71	1200	0	634	50	81	8.0	0.01	1.00	160	8	34	240	2.22	780	240
20U/45	TONK	TONK	TONK (Raivens Industry)	TW	26.16	75.79	6.90	14400	0	159	4963	2697	1.5	0.01	0.50	6100	1064	837	1760	14.0	9360	60
20U/46	TONK	TONK	TONK (Near Hundai Showroom)	TW	26.16	75.79	7.65	1650	0	439	220	96	48	0.01	1.20	520	20	114	132	5.45	1073	4
20U/47	TONK	TONK	TONK (Gate of RSENL 132 KV SubStation)	TW	26.16	75.79	7.45	5350	0	134	1149	826	340	0.01	1.30	1110	92	214	800	16.0	3478	20
20U/48	TONK	TONK	TONK (Giriraj Temple)	TW	26.16	75.79	7.75	4350	0	549	638	536	440	0.01	0.75	520	44	100	800	6.30	2828	6
20U/49	TONK	Deoli	BANTHOLI	DW	25.98	75.97	7.55	4420	0	329	1049	342	130	0.01	1.00	680	52	134	670	61.7	2873	8
20U/50	TONK	Deoli	DEOLI	TW	26.24	75.85	7.84	2400	0	573	390	136	60	0.01	2.75	210	28	34	460	7.40	1560	600
20U/51	TONK	Tonk	Ghans	HP	25.93	75.88	7.76	1680	0	537	206	81	22	0.01	2.82	230	16	46	280	2.33	1092	100
20U/52	TONK	Malpura	JAISINGHPUR	DW	26.00	75.68	8.00	1540	0	695	92	80	27	0.01	5.30	100	12	17	330	3.02	1001	30
20U/53	TONK	Malpura	MALPURA1	DW	26.11	75.73	7.83	3160	0	720	461	333	100	0.01	2.40	260	16	54	650	1.86	2054	24
20U/54	TONK	Tonk	Mehndwas	DW	26.37	75.93	7.75	4310	0	634	893	315	119	0.01	1.64	490	20	107	790	2.63	2802	40
20U/55	TONK	Uniara	Sop1	TW	26.02	75.49	7.52	1730	0	317	170	307	48	0.01	0.72	290	32	51	260	6.30	1125	9
20U/56	TONK	Todaraisingh	TODARAISINGH1	DW	26.02	75.48	7.50	750	0	256	92	20	17	0.01	0.30	230	64	17	67	1.47	488	BDL
20U/57	TONK	TONK	UNIYARA	HP	25.92	76.03	7.72	3140	0	366	128	1144	14	0.15	1.20	410	48	71	560	47.0	2041	48
21U/1	CHURU	Sardar Sahar	Aspalsar	Tw	28.58	74.51	7.06	487.7	0	122	64	240	31	0.05	0.25	160	36	17	140	3.2	317	20
21U/2	GANGANAGAR	Suratgarh	Piperan	Tw	29.23	73.90	8.02	1940	0	720	163	220	120	0.08	11.90	370	24	75	368	8.2	1261	35.6
21U/3	GANGANAGAR	Anupgarh	Anupgarh	Dug	29.11	73.13	7.55	2720	0	329	454	390	275	0.08	0.44	610	124	73	410	30	1768	10

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21U/4	GANGANAGAR	Anupgarh	Khal	HP	29.08	73.37	7.7	1100	0	244	85	150	110	0.05	2.25	370	64	51	92	8.2	715	9
21U/5	GANGANAGAR	Suratgarh	Birdhwal	Tw	29.11	73.90	8.04	5550	0	708	1319	360	34	0.26	18.20	190	36	24	1250	5.4	3608	65
21U/6	GANGANAGAR	Sadul Sahar	Ganeshgarh	Tw	29.75	73.91	7.71	426.3	0	232	21	20	3	0.02	0.50	200	40	24	20	5.6	277	90
21U/7	GANGANAGAR	Karanpur	Karanpur	Tw	29.83	73.45	7.59	1180	0	256	121	250	17	0.01	0.75	470	84	63	76	10.1	767	10
21U/8	GANGANAGAR	Karanpur	Rupnagar	Tw	29.79	73.44	6.68	8450	0	260	2600	780	1	0.65	1.10	2620	680	224	950	34	5493	45
21U/9	GANGANAGAR	Raisinghnagar	Raisinghnagar	HP	29.32	73.27	7.7	2190	0	464	269	150	180	0.02	1.00	670	84	112	166	22.5	1424	20
21U/10	HANUMANGARH	Tibi	Tibi	HP	29.56	73.50	8.2	4160	0	622	496	720	272	0.11	3.15	320	32	58	850	9.1	2704	25
21U/11	HANUMANGARH	Sangariya	Sangariya	Tw	29.82	74.48	7.77	2440	0	256	71	925	26	0.02	1.90	1010	228	107	136	16	1586	102
21U/12	HANUMANGARH	Sangariya	Bolanwali	HP	29.50	74.24	7.89	3120	0	622	503	145	280	0.06	1.10	710	108	107	402	13	2028	0
21U/13	GANGANAGAR	Sadul Sahar	Suranwali	Tw	29.70	73.92	7.71	796.7	0	183	160	10	3	0.02	1.65	330	88	27	30	6.31	518	0
21U/14	HANUMANGARH	Hanumangarh	Panditawali	HP	29.41	74.20	7.64	6990	0	183	1450	1220	18	0.92	1.68	1930	432	207	720	26	4544	14
21U/15	GANGANAGAR	Ganganagar	Ganganagar	HP	29.94	73.86	7.89	3390	0	525	432	500	270	0.11	0.95	680	76	119	490	33	2204	220
21U/16	HANUMANGARH	Hanumangarh	Hanumangarh	Tw	29.62	74.28	7.8	1060	0	305	99	110	46	0.02	0.58	340	68	41	92	6	689	5
30U/1	JODHPUR	Balesar	Balesar	TW	26.40	72.49	7.11	1890	0	195	347	187	130	0.01	0.65	450	116	39	230	3	1229	4.570
30U/2	JODHPUR	Shergarh	Shergarh	TW	26.32	72.28	7.85	3130	0	293	780	190	44	0.02	1.60	270	48	36	600	4.28	2035	8
30U/3	JODHPUR	Shergarh	Nahar Singh Nagar	TW	26.39	72.29	7.85	5020	0	439	1262	363	50	0.03	1.20	490	76	73	950	6.4	3263	10
30U/4	JODHPUR	Dechu	Dechu Pz	TW	26.77	72.33	7.52	5400	0	390	1333	486	18	0.01	1.10	680	96	107	930	19.44	3510	12
30U/5	JODHPUR	Phalodi	Kolu	TW	26.55	72.18	7.75	3120	0	403	666	270.0	6.3	0.05	1.26	380	52	61	540	6.54	2028	16
30U/6	JAISALMER	Sankra	Lawan	DW	26.52	72.03	7.67	3820	0	695	666	222	230	0.02	1.58	320	32	58	740	3.51	2483	27
30U/7	BARMER	Sheo	Gujrokabera	TW	26.20	71.33	7.92	3200	0	427	666	283	70.0	0.05	2.05	330	40	56	600	11.32	2080	24
30U/8	BARMER	Sheo	Bisukalan	TW	26.26	71.29	7.85	9250	0	220	2871	515	2.6	0.10	2.70	920	136	141	1760	25.00	6013	2
30U/9	BARMER	Sheo	GADRA ROAD	TW	25.74	70.64	8.04	2850	0	854	617	118	4.0	0.01	2.00	170	24	27	700	10	1853	29
30U/10	BARMER	Sheo	PANCHLA	TW	25.99	70.17	7.51	13500	0	232	4467	470	9.0	0.02	1.70	108	72	219	2700	34	8775	3

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																0						
30U/11	JAISALMER	Jaisalmer	MOOLSAGAR	TW	26.91	70.84	7.96	2100	0	561	333	101	50.0	0.02	1.45	270	24	51	370	5.75	1365	4
30U/12	JAISALMER	Sam	Ranau	TW	27.59	70.45	7.90	2640	0	195	638	240	15.0	0.03	0.95	230	36	34	500	6.96	1716	7
30U/13	JAISALMER	JAISALMER	GHANTIYALI	TW	27.45	71.46	7.90	3680	0	293	964	252	31.0	0.04	1.25	230	36	34	760	9.23	2392	20
30U/14	JAISALMER	Sam	NATHU KA BERA	TW	27.81	70.42	7.89	5000	0	244	1290	538	44	0.01	0.65	320	40	54	1050	13	3250	7
30U/15	JAISALMER	Sam	KURIA	TW	26.62	70.49	8.02	2880	0	305	624	278	24	0.02	0.80	150	36	15	590	8.5	1872	14
30U/16	JAISALMER	Sam	Tanot	TW	27.48	70.22	8.19	7980	0	342	1914	715	450	0.02	0.45	720	96	117	1540	18.5	5187	28
30U/17	JAISALMER	Sam	Khariakua_DW	TW	27.72	70.33	7.56	12350	0	244	4077	1073	16.7	0.02	0.40	1180	168	185	2700	27.0	8028	4
30U/18	JAISALMER	Sam	SADEWALA	TW	27.63	70.24	7.64	9750	0	244	2765	687	305	0.01	1.30	900	120	146	1900	29.17	6338	4
30U/19	JAISALMER	Sam	Gajsingh ka Kua	TW	27.69	70.30	7.54	5270	0	134	1489	422	16	0.01	1.00	580	112	73	950	17.01	3426	4
30U/20	JAISALMER	Sam	Longewala	TW	27.15	71.77	7.99	3600	0	207	1078	187	7.5	0.01	1.68	580	44	114	600	10.67	2340	8
30U/21	JAISALMER	Sam	GOTARU	TW	27.32	70.04	8.02	2450	0	256	631	108	17	0.01	1.00	160	32	19	490	4.90	1593	10
30U/22	JAISALMER	Sankara	Madasar	DW	26.76	71.50	7.93	2400	0	427	503	130	37	0.20	0.91	330	68	39	390	39.86	1560	13
30U/23	JAISALMER	Sankara	Janpatpura	HP	26.70	71.69	8.00	7910	0	878	1914	580	255	0.40	6.60	500	48	92	1720	7.80	5142	45
30U/24	JAISALMER	Sankara	Sankara	TW	26.73	71.58	7.81	3900	0	476	581	274	590	0.15	1.40	580	160	44	630	20.45	2535	14
30U/25	JAISALMER	Sankra	GUDI KA TALA	Dug	26.77	71.64	7.75	1320	0	586	113	18	29	6.14	0.60	170	40	17	166	120.00	858	2
30U/26	JAISALMER	Sankra	LUNA KALAN	HP	26.68	71.58	8.06	3530	0	622	510	162	500	0.05	1.75	290	36	49	670	48.56	2295	10
30U/27	JAISALMER	Sankra	BHAINSARA	TW	26.61	71.49	7.81	2060	0	451	383	120	12.7	0.02	0.90	220	20	41	375	12.00	1339	13
30U/28	JAISALMER	Sankra	RAJGARH1	TW	26.56	71.50	8.25	4420	0	1049	993	2	10	0.03	4.20	110	12	19	990	17.06	2873	50
30U/29	JAISALMER	Sankra	Bonada	TW	26.52	71.53	7.97	760	0	195	64	46	100	0.15	0.80	180	44	17	88	9.22	494	5
30U/30	JAISALMER	Sam	Kodiyasar	TW	26.48	71.28	7.84	3930	0	342	964	302	5.0	0.13	2.79	410	56	66	710	11.51	2555	5
30U/31	JAISALMER	Sam	RAMA	TW	26.55	71.04	7.90	2230	0	329	553.0	48.0	3.5	0.01	2.10	220	44	26.8	405	7.70	1450	22
30U/32	JAISALMER	JAISALMER	Baishaki	TW	27.02	70.54	7.74	1180	0	512	43	115	1.0	0.02	1.72	230	44	29	170	7.00	767	1
30U/33	JAISALMER	JAISALMER	Chodahariya	TW	27.06	70.55	7.85	4390	0	415	1106	288	4.3	0.01	1.72	540	84	80	756	20.00	2854	BDL

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30U/34	JAISALMER	JAISALMER	Jaisalmer	TW	26.90	70.91	7.69	4450	0	451	1106	336	1.0	0.02	1.15	630	56	119	750	19.7	2893	BDL
30U/35	JAISALMER	Jaisalmer	CHANDAN	TW	26.99	71.30	7.99	4740	0	378	1134	468	1.7	0.03	1.70	480	128	39	880	9.16	3081	20
30U/36	JAISALMER	Sankra	SRIBHADRIA	TW	27.08	71.55	7.30	5570	0	281	1475	522	17.7	0.03	0.65	640	160	58	980	78.60	3621	5
30U/37	JAISALMER	Sankra	KALEWA	TW	26.81	71.90	7.78	7460	0	634	1950	357	150	0.01	2.00	720	112	107	1400	5.40	4849	20
30U/38	That	Sankra	JAISALMER	HP	26.85	71.83	8.13	2330	0	561	369	132	60	0.01	2.40	170	32	22	460	2.84	1515	7
30U/39	JAISALMER	Sankra	Guddi	HP	26.79	71.78	7.92	6840	0	573	1950	187	110	0.01	3.75	900	48	190	1200	4.8	4446	8
30U/40	JAISALMER	Sankra	Badli (Pokaran Gramin)	TW	26.87	71.87	7.70	4340	0	573	936	404	90	0.01	2.00	480	56	83	830	5.37	2821	20
30U/41	JAISALMER	Sankra	Pokaran	TW	26.92	71.91	7.62	3140	0	329	539	340	275	0.90	0.95	380	20	80	550	27.00	2041	9
30U/42	JAISALMER	Jaisalmer	Sataya_DW	TW	27.42	71.66	8.08	2610	0	342	553	355	14	0.13	1.85	400	44	71	465	30	1697	22
30U/43	JODHPUR	Bap	Bap	DW	27.36	72.35	7.87	3820	0	415	993	182	11	0.02	1.41	300	60	36	750	11.20	2483	12
30U/44	JODHPUR	Phalodi	Phalodi	TW	27.12	72.38	7.96	2050	0	427	425	32	50.0	0.01	1.65	240	32	39	360	5.90	1333	11
30U/45	JODHPUR	Lohawat	Lohawat	TW	26.98	72.59	7.90	1280	0	159	206	153	75	0.01	0.65	250	60	24	176	7.9	832	10
30U/46	JODHPUR	Bap	NokhraCharna	TW	27.23	72.89	7.84	5500	0	207	1375	605	17	0.20	1.15	770	148	97	910	8.94	3575	12
30U/47	JODHPUR	Osian	Osian	TW	26.74	72.90	7.72	4025	0	390	1120	86	50	0.21	1.45	550	92	78	680	6.2	2616	9
30U/48	JODHPUR	Osian	Jaychandon Ki dhano	TW	######	72.88	8.21	1920	0	366	369	137	27	0.25	1.20	180	32	24	370	4.15	1248	13
30U/49	JODHPUR	Osian	Haripura	TW	26.76	72.87	7.95	2050	0	354	404	135	34	0.01	1.25	170	40	17	395	4.0	1333	40
30U/50	JODHPUR	Osian	Shirmandi	TW	26.75	72.87	8.27	2220	0	415	418	152	60	0.02	1.20	190	28	29	435	4.70	1443	7
30U/51	JODHPUR	Osian	Kumbharo ki Dhani	TW	26.80	72.90	8.10	2270	0	305	496	174	16	0.02	1.65	210	32	32	430	4.50	1476	15
32U/1	PALI	Marwar Junction	Marwar Junction	T/w	25.73	73.60	8.23	2670	0	720	461	10	90	0.05	4.70	140	32	15	550	2	1736	78.93
32U/2	PALI	Pali	Gundoj	H/p	25.61	73.31	7.5	4980	0	488	851	730	258	0.25	1.98	1080	196	143	660	49	3237	17.2
32U/3	PALI	Rani	Kirwa	D/w	25.50	73.26	7.96	668.2	0	160	130	22	5	0.05	1.10	170	28	24	80	3.5	434	13.7
32U/4	PALI	Rani	Rani	H/p	25.35	73.31	7.68	2050	0	403	121	345	240	0.08	1.55	220	52	22	380	9.8	1333	13.8

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32U/5	PALI	Desuri	Desuri	D/w	25.27	73.56	7.34	2850	0	244	695	190	60	0.06	1.50	660	128	83	350	10	1853	20.16
32U/6	PALI	Desuri	Ghanerao	D/w	25.23	73.53	7.96	2790	0	805	482	40	26	0.09	4.50	350	36	63	490	1.47	1814	43.3
32U/7	PALI	Bali	Radawas	H/p	25.18	73.29	7.95	1330	0	525	121	45	25	0.02	1.57	230	24	41	200	9.1	865	14.8
32U/8	PALI	Bali	Bali	DcB	25.19	73.28	7.66	1770	0	293	305	220	40	0.06	0.20	530	44	102	180	8	1151	37.5
32U/9	PALI	Sumerpur	Balwana	H/p	25.11	73.16	7.16	1220	0	305	199	10	97	0.05	0.95	380	88	39	110	4	793	19.7
32U/10	PALI	Sumerpur	Sumerpur	T/w	25.15	73.07	7.81	3250	0	378	482	330	360	0.11	3.95	470	40	90	505	53	2113	51.4
32U/11	SIROHI	Sheoganj	Sheoganj (H/s)	H/p	25.14	73.07	7.24	2410	0	195	425	135	400	0.25	0.20	660	152	68	255	10	1567	20.0
32U/12	SIROHI	Sheoganj	Palri Jod	D/w	25.12	73.04	7.21	4710	0	342	1333	395	7.5	0.11	1.95	950	148	141	750	2	3062	1.2
32U/13	SIROHI	Sheoganj	Bera Ram pura	D/w	25.08	72.99	8.05	374.8	0	130	71	7	14	0.12	0.70	180	32	24	23	1	244	3.2
32U/14	SIROHI	Sheoganj	Palri (M)	t/w	25.01	72.92	7.46	2720	0	195	808	47	13	0.15	3.52	280	108	2	500	5	1768	1.2
32U/15	SIROHI	Sheoganj	Ambeshwari	H/p	24.96	72.89	7.6	980	0	366	121	20	1	0.05	3.32	260	76	17	110	6	637	10.2
32U/16	SIROHI	Pindwara	Veerwara	T/w	24.84	72.99	7.59	2010	0	293	445	98	160	0.06	2.10	490	76	73	250	58	1307	12.3
32U/17	SIROHI	Abu Road	Mt Abu	T/w	24.59	72.71	7.33	1056	0	195	199	85	7	0.02	1.51	210	64	12	150	4	686	11.1
32U/18	SIROHI	Abu Road	Manpur 2	T/w	24.50	72.76	7.51	1650	0	268	319	88	105	0.04	2.29	420	60	66	200	2.3	1073	26.3
32U/19	SIROHI	Abu Road	Mungthala	H/p	24.48	72.68	7.39	848.6	0	207	128	70	55	0.08	0.80	210	44	24	120	2.4	552	24.3
32U/20	SIROHI	Reodar	Jeerawal	D/w	24.64	72.49	7.57	625	0	171	57	50	37	0.08	2.67	160	44	12	70	1.3	406	10.6
32U/21	SIROHI	Reodar	Gulabganj	H/p	24.68	72.68	7.42	720	0	195	78	65	40	0.09	0.80	180	28	27	90	7	468	BDL
32U/22	JALORE	Jaswantpura	Jaswantpura	D/w	24.82	72.45	7.6	690	0	160	102	35	27	0.02	3.20	170	44	15	80	1	449	BDL

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32U/23	SIROHI	Sirohi	Kalandri	D/w	24.93	72.69	7.75	5690	0	378	1234	710	140	0.06	3.60	740	88	126	980	38	3699	15.6
32U/24	SIROHI	Sirohi	Barlot	D/w	24.99	72.73	7.77	449	0	159	57	5	14	0.06	1.10	130	24	17	45	2	292	14.1
32U/25	JALORE	Bhinmal	Ledarmer	D/w	25.05	72.35	7.61	4410	0	390	1205	140	41	0.11	1.20	700	184	58	690	5	2867	17.78
32U/26	JALORE	Bhinmal	Khanpur	T/w	25.02	72.35	7.84	3650	0	183	1021	230	1	0.25	5.00	360	56	54	680	4	2373	3
32U/27	JALORE	Bhinmal	Bhinmal	D/w	25.01	72.26	7.87	4170	0	1147	177	895	110	0.11	8.40	920	160	126	602	8	2711	74.6
32U/28	JALORE	Bhinmal	Narta	T/w	25.09	72.27	7.51	8650	0	183	2446	760	190	0.13	2.80	950	320	36	1650	12	5623	6.3
32U/29	JALORE	Bhinmal	Bhagal Bhim (H/s)	T/w	25.02	72.22	7.9	4190	0	476	1028	190	85	0.15	4.40	400	56	63	790	2	2724	33.8
32U/30	JALORE	Bhinmal	Bhagal Bhim	T/w	25.01	72.21	7.87	3130	0	464	652	195	17	0.05	3.95	200	32	29	620	1.7	2035	24.6
32U/31	JALORE	Bhinmal	Pradhan ki Dhani	T/w	25.03	72.20	7.45	7000	0	403	1950	365	110	0.08	3.65	840	164	105	1250	5	4550	25.8
32U/32	JALORE	Bhinmal	Bhagal Bhim	T/w	25.02	72.24	7.67	5250	0	281	1450	44	370	0.06	3.35	300	72	29	1070	5	3413	26.7
32U/33	JALORE	Raniwara	Dhanawara	T/w	24.67	72.22	7.82	1110	0	305	184	180	9	0.09	2.00	290	72	27	190	3.4	722	5.9
32U/34	JALORE	Raniwara	Raniwara	T/w	24.78	72.23	7.61	895	0	260	142	10	36	0.02	0.38	120	36	7	150	4	582	8.5
32U/35	JALORE	Raniwara	Matriwara	T/w	24.71	72.09	8.11	1920	0	220	284	401	40	0.06	2.80	210	32	32	380	1.7	1248	36.3
32U/36	JALORE	Chitalwana	Halibao	T/w	24.99	71.59	7.95	680.2	0	420	85	40	8	0.05	1.40	340	20	71	81	7	442	6.08
32U/37	JALORE	Chitalwana	Doongri	D/w	24.94	71.41	7.94	1600	0	329	184	285	70	0.11	2.60	400	32	78	225	6	1040	1.1
32U/38	BARMER	Chohtan	Tarla	D/w	24.84	71.22	7.83	1450	0	281	177	130	200	0.25	0.85	110	32	7	250	103	943	5.09
32U/39	BARMER	Chohtan	Salriya	T/w	25.07	71.11	8.01	3286	0	366	759	280	80	0.11	0.88	190	52	15	705	6	2136	18.03
32U/40	JALORE	Sanchore	Sanchore (H/s)	T/w	24.75	71.78	8.04	4620	0	817	886	120	340	0.12	7.20	160	28	22	1000	2	3003	33.8

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32U/41	JALORE	Sanchore	Hotel Kaushal Int, Sanchore Highway	T/w	24.78	71.78	8.05	1660	0	329	298	250	11	0.06	1.10	180	32	24	360	2.1	1079	11.2
32U/42	JALORE	Sanchore	Temple, Sanchore-Barmer Highway	T/w	25.77	71.78	7.9	4510	0	403	1120	290	50	0.09	3.68	90	16	12	1000	2	2932	15.01
32U/43	JALORE	Sanchore	Dhaba at Raniwara-Sanchore Highway	T/w	24.74	71.78	7.63	1440	0	171	199	285	5	0.02	0.70	200	28	32	240	2.03	936	1.8
32U/44	JALORE	Jalore	Bagra	T/w	25.19	72.60	7.34	8600	0	293	1737	1550	40	0.06	1.42	1850	220	316	1150	5	5590	2
32U/45	JALORE	Jalore	Bhagli	T/w	25.28	72.60	7.48	1900	0	244	347	235	22	0.14	1.14	440	72	63	236	2.1	1235	7.1
32U/46	JALORE	Jalore	Jalore (H/s)	T/w	25.33	72.63	7.14	3730	0	244	836	312	193	0.10	2.05	1260	340	100	278	3	2425	2.9
32U/47	JALORE	Jalore	Jalore	T/w	25.30	72.63	7.73	18400	0	720	4608	1958	78	0.01	2.50	1400	260	182	3588	2.5	11960	27
32U/48	BARMER	Sindhari	Loona kalan	T/w	25.45	71.98	8.92	14700	120	256	3828	1364	86	0.09	1.91	500	80	73	3150	8.6	9555	24
32U/49	BARMER	Sindhari	Arniyali	T/w	25.47	71.97	7.92	14120	0	586	3934	954	41	0.05	1.20	1050	160	158	2772	10	9178	21
32U/50	BARMER	Sindhari	Khara Mahecha	H/p	25.51	72.03	7.94	13280	0	1024	3580	690	35	0.07	0.98	950	180	122	2622	10	8632	60
32U/51	BARMER	Sindhari	Bhoginji ka Meetha (H/s)	T/w	25.21	72.13	7.97	4635	0	707	836	414	150	0.07	2.50	300	60	36	928	3.8	3013	21
32U/52	BARMER	Sindhari	Dhanwa	T/w	25.55	72.12	7.73	7645	0	671	1956	446	56	0.04	1.38	400	88	44	1575	6.6	4969	37
32U/53	BARMER	Sindhari	Bhoginji ka Meetha	T/w	25.51	72.12	7.91	6050	0	500	1418	508	101	0.05	1.45	420	96	44	1198	3.6	3933	29
32U/54	BARMER	Sindhari	Bhoginji ka Meetha	T/w	25.53	72.12	8.17	4640	0	403	865	644	115	0.15	1.55	280	64	29	936	4.2	3016	28
32U/55	BARMER	Barmer	Sansiyon ka Tala (H/s)	D/w	25.70	71.41	7.96	5650	0	188	1162	872	145	0.12	1.39	600	64	107	1014	18	3673	7.3
32U/56	BARMER	Barmer	Dhani at Sansiyon ka Tala	T/w	25.69	71.39	7.48	5195	0	220	1276	588	1	0.01	1.30	800	120	122	818	19	3377	3.2

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32U/57	BARMER	Barmer	Hotel Sanchal Fort, Mahabar	T/w	25.71	71.41	7.92	3000	0	329	638	263	43	0.24	1.52	400	54	64	502	11.2	1950	3.6
32U/58	BARMER	Barmer	Vatika Kaushal Int , Gadan	T/w	25.69	71.39	7.52	2720	0	464	532	182	49	0.14	0.57	230	40	32	518	7.9	1768	1.3
32U/59	BARMER	Barmer	Sanwlor (H/s)	D/w	25.59	71.23	7.91	2430	0	155	539	250	80	0.04	0.51	310	56	41	410	13	1580	8.8
32U/60	BARMER	Barmer	Ashok ki Dhani, Sawlor	D/w	25.61	71.26	7.76	6600	0	244	1737	526	125	0.10	0.35	380	60	56	1336	14	4290	3.1
32U/61	BARMER	Barmer	Sanwlor Stone Crusher, Sanwlor	T/w	25.61	71.27	7.64	1720	0	256	255	206	86	0.03	1.01	290	56	36	260	4.1	1118	4.3
32U/62	BARMER	Barmer	Khairaj Ram ki Dhani, Sanwlor	T/w	25.59	71.23	7.73	3345	0	329	786	204	99	0.16	0.34	290	76	24	632	8.5	2174	3.8
32U/63	BARMER	Chohtan	Chohtan	D/w	25.48	71.08	7.79	1770	0	268	234	132	244	0.08	0.52	440	80	58	189	30	1151	12
32U/64	BARMER	Chohtan	Siyaga Tala	D/w	25.34	70.87	7.76	6900	0	195	1702	664	238	0.04	1.57	280	60	32	1451	14	4485	11
32U/65	BARMER	Chohtan	Dhanau	T/w	25.28	71.12	7.72	3140	0	207	730	309	54	0.12	2.47	220	52	22	586	63	2041	23
32U/66	BARMER	Dhorimana	Dhorimana (H/s)	T/w	25.21	71.44	7.93	8060	0	525	1262	1600	180	0.12	2.02	1040	116	182	1372	10	5239	29
32U/67	BARMER	Dhorimana	Gaushala, Nerinadi	T/w	25.22	71.41	8.02	6670	0	451	1271	1092	99	0.07	1.86	600	64	107	1278	8.1	4336	23
32U/68	BARMER	Dhorimana	Bheelon ki Dhani	T/w	25.23	71.47	8.03	7380	0	402	1432	1190	97	0.09	1.06	560	72	92	1433	13	4797	20
32U/69	BARMER	Dhorimana	Hari om Hotel, Highway	T/w	25.23	71.44	8.41	4470	12	159	936	653	125	0.07	1.30	280	44	41	895	11	2906	22
32U/70	BARMER	Gudamalani	Gudamalani (H/s)	T/w	25.20	71.71	7.9	9195	0	293	1758	1612	239	0.04	1.82	880	112	146	1707	6.3	5977	41
32U/71	BARMER	Gudamalani	Rathoro ki Dhani, Gudamalani	T/w	25.21	71.70	8.11	4085	0	634	723	468	0	0.11	5.74	360	60	51	774	3.3	2655	6.1
32U/72	BARMER	Barmer	Derasar (H/s)	D/w	25.78	71.16	7.84	594	0	171	57	56	18	0.02	0.44	175	32	23	45	19	386	19
32U/73	BARMER	Barmer	Mandal Eido ki Dhani, Derasar	H/p	25.81	71.14	7.85	2340	0	640	295	152	82	0.03	1.50	300	59	37	392	17	1521	16

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32U/74	BARMER	Barmer	Photaniyon ki Dhani, Bisalo ki Basti, Derasar	H/p	25.82	71.15	7.94	1730	0	536	173	156	20	0.03	0.64	120	16	19	337	11	1125	12
32U/75	BARMER	Barmer	Meethano ki Basti, Derasar	B/w	25.79	71.15	7.61	3465	0	354	518	301	492	0.06	0.72	860	84	158	398	6.6	2252	1.5
32U/76	BARMER	Ramsar	Ramsar (H/s)	H/p	25.73	70.87	8.88	20620	120	464	3827	4080	54	0.06	10.00	700	100	109	4416	46	13403	120
32U/77	BARMER	Baitu	Bhadka	T/w	25.88	71.35	7.89	3485	0	281	737	374	93	0.12	2.22	270	44	39	669	14	2265	2.66
32U/78	BARMER	Barmer	Sanawada (H/s)	D/w	25.49	71.41	7.75	7460	0	232	1762	912	120	0.14	1.12	880	104	151	1305	11	4849	7.7
32U/79	BARMER	Barmer	PHED Campus, Darziyon ki Dhani, Sanawara	T/w	25.46	71.40	7.77	5960	0	183	1701	359	70	0.04	0.22	740	112	112	1030	1.2	3874	6.1
32U/80	BARMER	Barmer	Lakhaniyon ki Dhani	T/w	25.47	71.41	7.59	6330	0	183	1843	325	95	0.06	0.10	720	144	88	1120	12	4115	7.9
32U/81	BARMER	Barmer	Doongar jee ki dhani	T/w	25.50	71.40	7.97	5930	0	134	1559	580	61	0.10	1.12	580	96	83	1094	8.8	3855	37
32U/82	BARMER	Sindhari	Chawa	T/w	25.75	71.67	7.67	21760	0	220	4537	3802	412	0.16	0.32	2900	320	511	3650	37	14144	15
32U/83	BARMER	Baitu	Sau PAdam Singh	T/w	26.19	71.81	7.8	6800	0	390	1276	1028	251	1.18	1.58	300	56	39	1419	12	4420	140
32U/84	BARMER	Baitu	Kerala	D/w	26.00	71.90	8.06	3970	0	329	851	349	185	0.04	0.71	220	36	32	810	5.5	2581	1.3
32U/85	BARMER	Baitu	Koloo	D/w	26.03	71.71	7.73	14380	0	146	3474	2063	14	0.16	4.05	1400	240	195	2691	21	9347	0.39
32U/86	PALI	Rohat	Vaed (H/s)	D/w	25.72	72.97	7.76	8810	0	378	2042	840	417	0.14	1.04	1400	200	219	1178	350	5727	0.55
32U/87	PALI	Rohat	Shiv Vatika Colony, Vaed	D/w	25.74	72.96	7.78	19180	0	98	5459	1305	537	0.10	6.51	1000	200	122	3946	10	12467	81
32U/88	JALORE	Ahore	Nimba (H/s)	D/w	25.53	72.87	8.23	2010	0	293	362	192	54	0.09	3.96	170	44	15	363	38	1307	16
43U/1	JODHPUR	LUNI	KUI	DW	26.21	73.06	7.7	3000	0	293	702	250	18	0.11	4.00	400	56	63	515	2	1950	39.3
43U/2	JODHPUR	LUNI	MOGRA	DW	26.12	73.03	7.19	4500	0	183	1234	335	55	0.12	1.65	580	152	49	750	60	2925	13.

Lab Id	District	Block	Location	Aqui- fer	Lat.	Long.	pH	EC(µS/cm at 25 deg.cel)	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	PO4 mg/l	F mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	TDS mg/l	U mg/l
																						9
43U/3	JODHPUR	LUNI	BUJHAWAR	DW	26.23	72.91	7.36	530	0	183	78	10	7.1	0.02	0.20	220	76	7	25	6	345	1.05
43U/4	JODHPUR	LUNI	RARON KI DHANI	DW	26.19	72.78	8.56	18000	120	1086	5530	502	300	0.22	5.80	1300	200	195	3850	16	11700	72
43U/5	JODHPUR	LUNI	KARANI	DW	26.27	72.83	7.48	6580	0	439	1520	740	75	0.32	4.00	400	56	63	1350	4	4277	28
43U/6	JODHPUR	KERU	SALODI	DW	26.41	72.85	7.92	3560	0	281	808	365	60	0.25	1.75	600	92	90	550	8	2314	22.5
43U/7	JODHPUR	BILARA	BHAWI	HP	26.23	73.61	8.21	3040	0	891	425	260	50	0.11	10.50	690	24	153	450	3	1976	88.5
43U/8	JODHPUR	BILARA	BENON	DW	26.14	73.42	8.5	14540	12	183	4750	620	42	0.65	1.50	2200	400	292	2450	20	9451	27.79
43U/9	JODHPUR	BHOPALGARH	RAMRAWAS	DW	26.37	73.38	8.51	7010	60	659	1773	310	90	0.12	3.95	500	60	85	1402	6	4557	67.27
43U/10	JODHPUR	MANDORE	BISALPUR	DW	26.23	73.31	7.56	4580	0	244	1262	450	65	0.22	0.70	880	184	102	740	20	2977	18.2
43U/11	JODHPUR	MANDORE	DANGIYAWAS	DW	26.26	73.28	7.86	2440	0	390	425	165	160	0.11	1.70	270	52	34	435	12	1586	28.1
43U/12	JODHPUR	LUNI	NARNADI	TW	26.16	72.89	7.76	16800	0	573	5318	490	165	0.85	1.40	1100	100	207	3450	18	10920	3.2
43U/13	JODHPUR	LUNI	JHAWAR	TW	26.19	72.86	7.56	2100	0	195	496	165	42	0.21	0.34	520	100	66	250	5	1365	16.5
43U/14	JODHPUR	LUNI	LUNAWAS KHARA	TW	26.17	72.80	7.77	4360	0	1037	737	225	150	0.22	1.29	400	56	63	850	2.8	2834	45.8
43U/15	JODHPUR	LUNI	KHUDALA	TW	26.14	72.84	7.46	4370	0	110	850	899	2	0.33	0.35	100	24	10	980	4.4	2841	3.6
43U/16	JODHPUR	LUNI	JATYASANI	TW	26.11	72.84	7.87	4700	0	464	986	598	9	0.62	1.80	250	48	32	980	20	3055	47.9
43U/17	JODHPUR	LUNI	GELAWAS	TW	26.07	72.78	7.92	4460	0	805	1432	75	55	0.60	4.70	400	60	61	1110	5	2899	64.3
43U/18	JODHPUR	LUNI	DHAWA	DW	26.06	72.74	7.76	3950	0	610	879	445	12	0.25	13.00	110	24	12	980	7	2568	57.2
43U/19	JODHPUR	LUNI	SINLI	HP	26.03	72.76	7.07	23220	0	220	7161	1780	2	0.22	1.35	480	920	608	3350	53	15093	1.7

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																0						
43U/20	BARMER	DOLI	DOLI RAJPURA	TW	26.06	72.68	8.04	4650	0	647	312	1450	31	0.29	5.40	380	44	66	990	3	3023	38.1
43U/21	PALI	SOJET	KHARIYA SODA	TW	25.81	73.64	8.13	2960	0	1110	347	106	2	0.12	2.40	270	28	49	575	1.2	1924	80
43U/22	PALI	SOJET	SOJET	TW	25.91	73.66	7.65	4190	0	854	369	800	16	0.22	2.00	420	44	75	760	4	2724	49
43U/23	JODHPUR	BHOPALGARH	KUMARA	TW	26.74	73.54	7.87	4560	0	464	893	702	35	0.25	1.88	610	124	73	820	12	2964	22.9
43U/24	JODHPUR	BHOPALGARH	BHOPALGARH	TW	26.65	73.50	7.58	2670	0	427	418	245	240	0.20	1.55	570	156	44	350	50	1736	10.5
43U/25	JODHPUR	BHOPALGARH	SARGIYA KALLA	TW	26.54	73.54	8.02	5000	0	476	1461	95	80	0.40	1.45	420	20	90	1010	4	3250	10.3
43U/26	JODHPUR	BHOPLAGARH	ARTIYA KALLA	TW	26.55	73.41	7.9	2360	0	451	390	185	82	0.11	1.80	290	80	22	410	4	1534	26.3
43U/27	JODHPUR	BHOPLAGARH	DEVATRA	DW	26.51	73.38	7.87	3380	0	805	199	760	32	0.22	2.30	560	60	100	550	6.1	2197	40.9
43U/28	JODHPUR	BHOPLAGARH	GODAWAS	TW	26.54	73.37	7.94	3310	0	464	650	335	35	0.25	2.60	330	52	49	620	4.5	2152	17.4
43U/29	JODHPUR	BHOPLAGARH	DEVATRA(IRANDI KA BERA)	DW	26.50	73.40	7.55	6260	0	390	1482	350	450	0.16	1.10	1530	200	250	740	9.9	4069	17.5
43U/30	JODHPUR	BHOPLAGARH	NANDIYA	TW	26.51	73.35	8.33	3930	12	1562	383	140	33	0.22	17.00	120	32	10	890	2.4	2555	152.7
43U/31	JODHPUR	KERU	LORDI	TW	26.31	72.83	7.65	3790	0	561	490	680	60	0.21	1.60	270	64	27	750	9.5	2464	32.3
43U/32	JODHPUR	KERU	JASNATH NAGAR	TW	26.33	72.77	8.28	4180	0	1110	666	220	30	0.22	10.00	190	36	24	890	2.8	2717	100
43U/33	JODHPUR	LUNI	CHICHARLI	TW	26.20	72.71	7.22	25000	0	366	12500	802	48	0.93	4.10	6100	880	948	5850	22.1	16250	97
43U/34	JODHPUR	LUNI	PARIHARON KI DHANI	TW	26.14	72.75	7.82	10000	0	744	2907	1150	95	0.64	3.10	600	180	36	2500	8.8	6500	36.6
43U/35	JODHPUR	LUNI	MANJ FORM HOUSE	TW	26.16	73.05	7.97	8120	0	1049	2020	350	80	0.58	17.20	600	180	36	1650	5.4	5278	55

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43U/36	JODHPUR	LUNI	DEELA	TW	26.10	73.07	8.06	2330	0	793	227	202	70	0.11	2.40	150	24	22	500	7.2	1515	35.8
43U/37	JODHPUR	LUNI	GUDA RAYKA	HP	26.13	73.09	8.74	7290	36	1391	1524	250	150	0.81	15.80	400	100	36	1550	13	4739	1035
43U/38	JODHPUR	LUNI	SALAWAS	HP	26.14	73.01	7.86	13390	0	805	3520	1150	90	0.76	8.90	1600	120	316	2450	8.2	8704	74.2
43U/39	JODHPUR	BAWARI	SOYLA	TW	26.49	73.20	7.29	1290	0	171	262	126	18	0.06	1.40	230	52	24	195	5.33	839	25
43U/40	NAGAUR	KHIMSAR	KHIMSAR	TW	26.99	73.40	7.51	7400	0	183	2198	450	42	0.65	1.78	1050	200	134	1250	7.5	4810	39.7
43U/41	NAGAUR	MUNDWA	MUNDWA	TW	27.03	73.79	7.66	4670	0	305	1305	270	10	0.63	3.80	350	64	46	940	5.1	3036	17.4
43U/42	NAGAUR	NAGAUR	NAGAUR(HS-1)	TW	27.16	73.71	8.04	6740	0	1037	993	820	500	0.66	10.00	240	32	39	1520	4.74	4381	70
43U/43	NAGAUR	NAGAUR	NAGAUR	TW	27.21	73.72	8.18	4800	0	781	709	702	240	0.33	7.50	240	32	39	1080	3.75	3120	49.3
43U/44	NAGAUR	NAGAUR	NAGAUR HS-2(GOGELAO)	TW	27.23	73.67	7.72	5630	0	488	1276	690	26	0.12	2.87	440	64	68	1150	4.1	3660	20.6
43U/45	NAGAUR	NAGAUR	NAGAUR HS-3	TW	27.23	73.78	7.3	8230	0	220	1950	1210	180	0.52	3.30	2500	680	195	850	4	5350	70
43U/46	NAGAUR	NAGAUR	NAGAUR HS-4	TW	27.20	73.70	7.86	6100	0	622	1305	660	60	0.32	5.20	360	16	78	1260	5.4	3965	45.7
43U/47	NAGAUR	JAYAL	JAYAL(RAJPUROHITO KI DHANI)HS-1	TW	27.21	74.20	7.76	3840	0	500	851	401	20	0.11	2.80	380	40	68	770	4.3	2496	42.2
43U/48	NAGAUR	JAYAL	JAYAL-HS-2(MATAJI KA XHORAHA)	TW	27.22	74.18	7.40	20250	0	305	6452	2268	38	0.15	1.00	2500	432	345	4250	6.88	13163	17
43U/49	NAGAUR	JAYAL	JAYAL-HS-3(GUJARIA BAS)	TW	27.24	74.19	7.80	2020	0	525	319	156	52	0.02	1.65	380	64	54	325	2.22	1313	16
43U/50	NAGAUR	JAYAL	JAYAL (DIDWANA ROAD)	TW	27.23	74.23	7.35	12800	0	268	4041	1315	8	0.21	1.30	2400	448	311	2250	8.83	8320	7
43U/51	NAGAUR	DIDWANA	CHHOTI KHATU	HP	27.09	74.20	7.78	2590	0	708	418	178	22	0.12	1.70	320	40	54	485	3.90	1684	7

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43U/52	NAGAUR	DEGANA	DEGANA	TW	26.49	74.21	8.10	10000	0	1318	2730	1127	290	0.01	2.82	800	64	156	2550	2.64	6500	3
43U/53	NAGAUR	DEGANA	CHOSLI(HS-1)LANGOD	TW	26.91	74.28	7.94	6230	0	525	1390	744	260	0.03	2.65	550	48	105	1300	5.67	4050	10
43U/54	NAGAUR	DEGANA	CHOSLI HS-2	TW	26.93	74.26	7.94	9600	0	830	2588	468	230	0.05	4.60	750	48	153	1960	3.80	6240	12
43U/55	NAGAUR	DEGANA	CHOSLI-HS	TW	26.55	74.15	7.92	4500	0	268	993	603	46	0.01	3.20	400	48	68	870	3.29	2925	15
43U/56	NAGAUR	DEGANA	CHOSLI(KHINWTANA) HS-3	TW	26.99	74.19	7.89	9310	0	964	2750	215	95	0.25	5.80	650	60	122	2000	3.6	6052	115
43U/57	NAGAUR	DEGANA	CHOSLI HS-4	TW	27.01	74.17	7.34	3850	0	342	908	324	55	0.02	2.48	380	72	49	720	3.58	2503	7
43U/58	NAGAUR	PARBATSAR	BAGOT(HS)	TW	26.81	74.59	7.68	5620	0	732	1248	419	225	0.12	1.45	540	72	88	1120	6.33	3653	6
43U/59	NAGAUR	PARBATSAR	BAGOT(HS-1)	TW	26.82	74.63	7.72	2000	0	342	425	120	1.0	0.05	0.95	230	44	29	355	6.96	1300	7
43U/60	NAGAUR	PARBATSAR	BAGOT(HS-2)	HP	26.80	74.56	7.92	8200	0	988	2233	497	32	0.10	2.29	900	120	146	1660	2.55	5330	4
43U/61	NAGAUR	PARBATSAR	BAGOT(HS-3)	TW	26.80	74.59	8.05	1100	0	512	113	17	12	0.20	1.85	200	24	34	190	0.66	715	6
43U/62	NAGAUR	PARBATSAR	BAGOT (HS-4)	TW	26.83	74.58	8.23	1090	0	451	106	15	66	0.10	1.20	190	32	27	184	1.9	709	13
43U/63	NAGAUR	RIYAN	RIYA BADI	TW	26.20	74.15	8.14	1300	0	415	170	111	2.0	0.06	1.80	60	8	10	295	2.16	845	5
43U/64	NAGAUR	MERTA	DANGAWAS(HS-1)PANCHOLIYA	TW	26.62	74.09	7.89	5650	0	866	1461	205	6.0	0.01	1.40	420	32	83	1180	7.15	3673	9
43U/65	NAGAUR	MERTA	DANGAWAS(HS-2)PRATAP KRISHI FARM	TW	26.24	74.06	7.43	9300	0	439	2765	595	26	0.02	2.00	1250	96	246	1680	4.36	6045	5
43U/66	NAGAUR	MERTA	DANGAWAS(HS-3)	TW	26.62	74.07	7.61	7720	0	634	2198	385	15	0.02	2.10	750	32	163	1512	3.22	5018	2
43U/67	NAGAUR	MERTA	DANGAWAS(HS-4)	TW	26.63	74.05	7.49	9100	0	671	2552	558	44	0.10	1.80	900	88	165	1780	3.46	5915	17
43U/68	NAGAUR	MERTA	DANGAWAS(H	TW	26.64	74.06	7.60	8650	0	598	2517	398	30	0.05	2.20	700	48	141	1740	2.7	5623	10
43U/69	PALI	JAITARAN	PRITHIVIPURA(HS)	DW	26.20	73.39	7.9	5940	0	1049	1163	450	67	0.22	3.30	540	80	83	1150	1	3861	58.3
43U/70	PALI	JAITARAN	PRITHIVIPURA(HS-1)	DW	26.20	73.82	8.03	4840	0	350	1050	740	22	0.32	3.20	290	12	63	1050	2.2	3146	99.5

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43U/71	PALI	JAITARAN	PRITHIVIPURA(HS-2)	DW	26.20	73.82	8.04	4910	0	1098	964	205	12	0.33	3.20	310	28	58	1000	3.8	3192	90.4
43U/72	PALI	JAITARAN	PRITHIVIPURA(HS-3)	DW	26.20	73.81	7.59	8280	0	305	2260	840	1.72	0.25	3.40	1650	360	182	1220	6.6	5382	0.9
43U/73	JODHPUR	BAWARI	GANGANI(HS)	DW	26.49	73.21	7.76	10800	0	781	2250	1180	550	0.62	8.80	1400	160	243	1850	73	7020	123
43U/74	JODHPUR	BAWARI	GANGANI(HS-1)	DW	26.49	73.21	8.07	9600	0	1000	2850	240	300	0.58	11.00	340	56	49	2320	5.4	6240	135
43U/75	JODHPUR	BAWARI	GANGANI(HS-2)	DW	26.49	73.20	8.08	4020	0	1366	482	150	180	0.22	13.50	150	24	22	920	3.2	2613	130
43U/76	JODHPUR	BAWARI	GANGANI(HS-3)	DW	26.49	73.22	7.55	2500	0	366	460	320	17	0.10	1.30	790	144	105	230	16	1625	26.5
43U/77	JODHPUR	BHOPALGARH	RAMRAWAS(HS-1)	DW	26.35	73.41	7.22	487.7	0	122	78	60	17	0.02	0.40	200	36	27	35	6	317	5.4
43U/78	JODHPUR	BHOPALGARH	RAMRAWAS(HS-)	DW	26.42	73.38	7.78	4720	0	439	1092	124	380	0.28	3.70	500	84	71	850	2.6	3068	48.4
43U/79	JODHPUR	BHOPALGARH	RAMRAWAS(HS-2)KHEDI SALVA	DW	26.43	73.35	7.38	12200	0	708	3474	550	290	0.52	5.50	1860	264	292	2050	7	7930	11.2
43U/80	JODHPUR	BHOPALGARH	RAMRAWAS(HS-3)	DW	26.44	73.37	8	5320	0	537	1219	489	140	0.22	5.35	400	56	63	1102	2.5	3458	79
43U/81	JODHPUR	BHOPALGARH	RAMRAWAS(SH-4)	DW	26.46	73.44	7.84	5770	0	1049	1060	370	410	0.25	0.90	360	48	58	1250	3	3751	23.1
43U/82	JODHPUR	BILARA	PIPARCITY	DW	26.40	73.53	7.37	8810	0	512	2836	185	90	0.22	2.10	1100	400	24	1650	8.5	5727	18
43U/83	JODHPUR	BILARA	BORUNDA	DW	26.47	73.79	7.65	5670	0	281	1560	440	24	0.65	1.95	700	136	88	1010	5	3686	14.3
43U/84	JODHPUR	BILARA	BHAVI(HS)	HP	26.23	73.61	8.18	2710	0	891	369	150	37	0.33	8.80	150	16	27	600	3	1762	84
43U/85	JODHPUR	BILARA	BHAVI(HS-1)LAMBA	TW	26.21	73.58	8.1	8530	0	793	2340	350	23	0.22	5.80	750	80	134	1650	2.9	5545	73.6
43U/86	JODHPUR	BILARA	BHAVI(HS-2)	TW	26.22	73.61	7.64	9630	0	756	2056	650	880	0.62	4.30	1200	180	182	1650	98	6260	53
43U/87	JODHPUR	BILARA	BHAVI (HS-3)OLVI	TW	26.22	73.45	8.18	2770	0	708	411	250	100	0.11	5.90	190	28	29	610	3	1801	80.4

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43U/88	JODHPUR	BILARA	OLVI	TW	26.24	73.46	8.16	2800	0	769	418	105	100	0.12	2.90	220	40	29	550	3.2	1820	80
43U/89	JODHPUR	BILARA	BINAWAS	DW	26.29	73.38	7.34	250	0	134	35	45	8.2	0.02	0.25	180	40	19	15	4	163	3.8
43U/90	JODHPUR	LUNI	BHANDU(HS-1)	TW	26.12	72.90	8.1	5250	0	695	1276	350	18	0.06	9.75	220	36	32	1180	3.8	3413	85.8
43U/91	JODHPUR	LUNI	BHANDU(HS)	DW	26.10	72.89	8.29	22500	0	329	7232	1140	22	0.22	5.20	1900	120	389	4500	18	14625	36
43U/92	JODHPUR	LUNI	BHANDU(HS-2)	DW	26.09	72.91	7.57	23910	0	561	7728	750	150	0.64	6.20	2100	280	340	4700	15	15542	175
43U/93	BARMER	SIWANA	SAMDARI(HS-1)	DW	25.83	72.58	7.8	3480	0	220	893	260	33	0.21	0.80	540	124	56	550	10	2262	18.7
43U/94	BARMER	SIWANA	SAMDARI(HS)	DW	25.82	72.59	6.91	14300	0	415	4850	502	20	0.49	1.55	2000	416	233	2650	12.4	9295	7.2
43U/95	BARMER	SIWANA	SAMDARI9(HS-2)	DW	25.82	72.59	7.76	3840	0	232	1078	102	26	0.11	0.89	580	68	100	580	10	2496	17.8
43U/96	BARMER	SIWANA	SAMDARI(HS-3)	DW	25.83	72.60	7.61	4700	0	390	1219	490	26	0.22	1.10	820	104	136	802	10	3055	14.1
43U/97	BARMER	SIWANA	SAMDARI(HS-4)	DW	25.85	72.58	7.69	6120	0	708	1160	950	32	0.32	2.30	300	32	54	1350	12	3978	37.9
43U/98	BARMER	BALOTARA	THOB(HS)	DW	26.01	72.38	7.23	15530	0	354	5034	450	140	0.83	2.80	1520	304	185	2950	39	10095	16
43U/99	BARMER	BALOTARA	THOB(HS-1)	DW	26.01	72.38	7.63	3410	0	293	601	640	27	0.25	3.50	470	84	63	590	28	2217	15.9
43U/100	BARMER	BALOTARA	BALOTARA	DW	25.83	72.24	7.71	8720	0	512	2375	640	10	0.92	1.10	540	84	80	1800	18	5668	8.7
43U/101	BARMER	BALOTARA	THOB (HS-2)	DW	26.05	72.38	7.69	3570	0	256	595	235	601	0.01	1.28	550	60	97	545	40	2321	18
43U/102	BARMER	BALOTARA	THOOMBLI	DW	26.23	72.52	8.03	3920	0	220	688	691	99	0.01	2.45	240	32	39	789	4.1	2548	49
43U/103	NAGAUR	MAKARANA	MAKARANA(BH)	TW	27.03	74.71	7.82	4550	0	793	673	489	193	0.01	3.82	310	40	51	902	5.8	2958	126
43U/104	NAGAUR	LADNU	LADNUN(BH)	TW	27.64	74.38	7.59	6375	0	232	1602	674	37	0.01	1.58	1070	104	197	971	7.1	4144	16
43U/105	NAGAUR	DIDWANA	SANWARD	TW	27.40	74.57	7.69	4020	0	573	694	347	243	0.03	1.34	750	60	146	578	5.3	2613	41
43U/106	NAGAUR	DIDWANA	DATAU(BH)	TW	27.40	74.57	7.64	4010	0	549	241	738	545	0.14	1.99	680	80	117	604	9.8	2607	23

Lab Id	District	Block	Location	Aqui- fer	Lat.	Long.	pH	EC(µS/cm at 25 deg.cel)	CO3 mg/l	HCO 3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	PO4 mg/l	F mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	TDS mg/l	U mg /l
43U/107	NAGAUR	KUCHAMAN	KUCHAMAN(BH)	TW	27.14	74.85	8.03	1450	0	219	390	200	39	0.01	0.98	130	20	19	388	1.2	943	46
43U/108	NAGAUR	PARBATSAR	NAWA	TW	27.03	75.00	7.63	7525	0	293	1871	816	38	0.01	0.45	800	104	131	1357	11	4891	4.5
43U/109	NAGAUR	PARBATSAR	PARBATSAR	TW	26.88	74.76	7.7	1227	0	287	78	74	233	0.01	0.28	220	32	34	179	5.2	798	12
43U/110	NAGAUR	DIDWANA	KOLIA	DW	27.40	74.57	7.69	1415	0	183	206	177	98	0.01	0.74	330	48	51	165	17	920	6.5
43U/111	PALI	JAITARAN	BASSI	DW	26.64	74.06	8.08	1250	0	256	213	91	6.6	0.16	5.73	120	20	17	232	2.1	813	48
43U/112	JODHPUR	BILARA	BILARA(BH)	TW	26.20	73.71	7.19	8570	0	536	2375	412	79	0.01	1.12	1320	200	199	1362	5.8	5571	32
43U/113	JODHPUR	OSIAN	TINWARI(BH)	TW	26.74	72.90	8.45	930	24	98	148	101	36	0.01	0.97	180	36	22	131	2.5	605	3.4
43U/114	NAGAUR	DIDWANA	SINGHANA	TW	27.40	74.57	7.6	6826	0	207	1808	1582	50	0.01	0.95	1840	144	360	1171	23	4437	45
43U/115	NAGAUR	DIDWANA	RAGUNATHPURA	DW	27.40	74.57	8.38	370	24	49	35	48	6.2	0.41	0.45	120	32	10	28	5.4	241	3.3

Heavy Metal analysis results of water samples collected in 2023 **AnnexureVI**

Lab Id	District	Block	Village	source	lat	long	Zn	Pb	Mn	Fe	Cu	As
							mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Ajmer	Peesangan	Lamana	DW	26.23	74.49	BDL	BDL	BDL	0	BDL	0.002
2	Ajmer	Peesangan	Mangaliyawas	DW	26.28	74.51	BDL	BDL	BDL	0	BDL	0.004
3	Ajmer	Peesangan	Tabiji	DW	26.36	74.62	BDL	0.010	BDL	0.058	BDL	0.001
4	Ajmer	Peesangan	Nasirabad	DW	26.29	74.74	0.39	0.004	0.040	1.442	0.014	0.001
5	Ajmer	Srinagar	Ramsar2	DW	26.27	74.86	BDL	BDL	0.010	0.033	0.008	0.001
6	Bhilwara	Asind	Asind	HP	25.73	74.33	BDL	BDL	BDL	0	BDL	0.001
7	Bhilwara	Asind	Badnor	HP	25.83	74.28	BDL	BDL	BDL	0.01	BDL	BDL
8	Bhilwara	Banera	Raila Road	DW	25.63	74.60	0.31	BDL	0.026	0.01	BDL	BDL
9	Bhilwara	Hurda	Gulabpura	DW	25.90	74.67	BDL	0.010	0.026	0.142	0.016	BDL
10	Bhilwara	Hurda	Hurda	HP	25.90	74.69	0.33	0.004	0.021	2.267	0.008	BDL
11	Bhilwara	Shahpura	Kanchan-Kala	DW	25.76	74.91	0.26	BDL	BDL	0.092	BDL	BDL
12	Bhilwara	Shahpura	Taswaria Khurd	DW	25.56	74.80	BDL	BDL	0.012	0	BDL	BDL
13	Bhilwara	Shahpura	Sopura	DW	25.60	74.90	BDL	BDL	BDL	0	BDL	0.004
14	Jaipur	Dudu	Mangarwara	DW	26.61	75.28	0.01	BDL	0.035	0	BDL	0.002
15	Jaipur	Dudu	Mozmabad	DW	26.68	75.36	BDL	BDL	BDL	0.908	BDL	0.001
16	Jaipur	Dudu	Nasnota	DW	26.80	75.44	BDL	BDL	BDL	0	BDL	0.002
17	Jaipur	Dudu	Pallukhurd	DW	26.74	75.33	BDL	BDL	BDL	0	BDL	0.001

18	Jaipur	Phagi	Bhojpura	DW	26.62	75.61	BDL	BDL	0.011	0.442	BDL	0.005
19	Jaipur	Phagi	Chakwara	DW	26.61	75.51	BDL	BDL	BDL	0.450	BDL	0.001
20	Jaipur	Phagi	Choru	DW	26.59	75.45	BDL	BDL	0.015	0.458	BDL	0.001
21	Jaipur	Phagi	Lasariya	DW	26.56	75.51	BDL	BDL	BDL	1.083	BDL	0.001
22	Jaipur	Phagi	Madhorajpur	DW	26.58	75.66	BDL	BDL	0.012	1.117	0.002	0.005
23	Jaipur	Phagi	Majhi Renwal	DW	26.70	75.68	BDL	0.004	0.012	0.933	BDL	0.002
24	Rajsamand	Bhim	Ghata	DW	25.78	74.18	BDL	0.004	0.011	0.275	BDL	0.004
25	Alwar	Kathumar	Kathumar	DW	27.31	77.08	BDL	0.010	BDL	0.133	BDL	0.001
26	Alwar	Laxmangarh	Lachmangarh	DW	27.37	76.86	0.03	0.058	0.140	0.483	BDL	0.001
27	Alwar	Rajgarh	Tehla	DW	27.27	76.55	0.03	BDL	0.194	0.175	0.001	0.001
28	Alwar	Rajgarh	Todi Ka Bas	DW	27.12	76.31	0.02	0.004	0.017	0.408	BDL	BDL
29	Bharatpur	Bayana	Salabad	DW	26.98	77.31	BDL	0.010	0.172	0.592	BDL	BDL
30	Bharatpur	Deeg	Deeg1	DW	27.48	77.34	0.03	0.008	0.832	0.617	0.010	0.001
31	Bharatpur	Deeg	Mandhera	DW	27.39	77.35	0.02	0.105	0.015	0.592	0.005	0.004
32	Bharatpur	Deeg	Sihora	DW	27.57	77.29	BDL	BDL	0.018	0.225	BDL	0.001
33	Bharatpur	Kaman	Jurahra	DW	27.79	77.21	BDL	0.004	0.032	0.925	BDL	0.003
34	Bharatpur	Kaman	Kaman	DW	27.66	77.27	BDL	BDL	0.067	0.075	BDL	0.004
35	Bharatpur	Rupbas	Dahinagaon	DW	27.01	77.53	0.09	BDL	0.012	0.275	0.01	0.002
36	Bharatpur	Rupbas	Khanua	DW	27.03	77.54	BDL	BDL	BDL	0.317	BDL	0.001
37	Bharatpur	Sewar	Chiksana	DW	27.18	77.66	BDL	BDL	0.018	0.225	BDL	0.002
38	Bharatpur	Sewar	Ludhawai_Gwd	DW	27.17	77.40	BDL	BDL	0.026	0.108	BDL	0.001

39	Bharatpur	Sewar	Sewar	DW	27.18	77.44	BDL	BDL	0.055	0	BDL	0.005
40	Dausa	Dausa	Bapi	DW	26.98	76.29	0.04	BDL	0.318	0.283	BDL	BDL
41	Dausa	Dausa	Baniyana	HP	26.82	76.29	0.18	BDL	BDL	0.050	BDL	0.004
42	Dausa	Dausa	Bhandarej	DW	26.92	76.43	0.47	BDL	BDL	0	BDL	0.002
43	Dausa	Dausa	Dausa1	DW	26.90	76.33	BDL	BDL	BDL	0	BDL	0.001
44	Dausa	Lawan	Lawan1	TW	26.82	76.29	BDL	BDL	BDL	0	BDL	0.002
45	Dausa	Mahwa	Higetawari Dhani	DW	26.91	77.02	BDL	BDL	0.012	0	BDL	0.001
46	Dausa	Mahwa	Mahuwa	DW	27.05	76.93	BDL	BDL	BDL	0	BDL	0.005
47	Dhaulpur	Dhaulpur	Dhaulpur	DW	26.69	77.89	BDL	BDL	0.032	0.317	BDL	0.001
48	Dhaulpur	Dhaulpur	Aathmeel	DW	26.65	77.80	BDL	BDL	0.017	0.433	BDL	0.001
49	Dhaulpur	Dhaulpur	Kanthri	HP	26.86	77.72	BDL	BDL	0.016	0.475	0.008	0.001
50	Dhaulpur	Rajakhera	Mangraul	HP	26.81	77.97	BDL	BDL	0.010	0.458	BDL	0.004
51	Dhaulpur	Rajakhera	Rajakhera	TW	26.91	78.17	BDL	0.127	BDL	0	BDL	0.002
52	Dhaulpur	Rajakhera	Samaliyapura	TW	26.85	78.10	BDL	0.008	BDL	0	0.001	0.004
53	Dhaulpur	Saipau	Saipau	HP	26.82	77.76	0.03	BDL	BDL	0.460	BDL	0.001
54	Karauli	Hindaun	Badh Kamla	DW	26.69	76.93	BDL	BDL	BDL	0.080	0.004	0.001
55	Karauli	Hindaun	Hindaun	DW	26.72	77.03	0.07	BDL	0.032	0.063	0.01	0.001
56	Karauli	Karauli	Karsai	DW	26.42	76.94	0.05	BDL	0.030	0.117	BDL	BDL
57	Karauli	Nadoti	Nadauti	DW	26.71	76.72	BDL	BDL	0.020	0	BDL	0.002
58	Karauli	Nadoti	Sahar1	DW	26.61	76.73	BDL	BDL	0.011	0.063	0.004	0.004
59	Sawai Madhopur	Bamanwas	Bamnawas	HP	26.55	76.57	BDL	0.076	BDL	0.040	0.012	0.005

60	Dungarpur	Bichhiwara	Ratanpur	DW	23.76	73.45	BDL	BDL	BDL	0.130	0.01	0.006
61	Dungarpur	Simalwara	Kua	DW	23.47	73.91	0.10	0.005	0.013	0.040	0.004	0.001
62	Pratapgarh	Arnod	Moheda	DW	23.78	74.86	0.24	0.005	BDL	0.060	0.012	0.002
63	Pratapgarh	Chhotisadri	Choti Sadri	DW	24.39	74.70	0.14	0.005	BDL	0.090	0.006	BDL
64	Pratapgarh	Pratapgarh	Mokhampura	DW	24.02	74.88	0.01	BDL	0.017	0.097	0.006	BDL
65	Udaipur	Phalasiya	Phalasiya	DW	24.24	73.38	BDL	BDL	0.030	0.080	0.006	0.001
66	Udaipur	Sarada	Dingri	DW	24.22	73.87	0.02	BDL	0.044	0.037	0.004	0.001
67	Baran	Atru	Atru1	DW	24.88	76.67	BDL	BDL	0.013	0	0.004	0.004
68	Baran	Atru	Kanwai	DW	24.76	76.73	0.01	BDL	BDL	0.050	0.004	0.002
69	Baran	Atru	Udpuria	DW	25.29	76.32	BDL	0.005	BDL	0	0.006	BDL
70	Baran	Baran	Bamla	TW	25.00	76.48	BDL	BDL	BDL	0	0.006	0.001
71	Baran	Baran	Baran	DW	25.10	76.52	BDL	BDL	BDL	0	BDL	0.001
72	Baran	Shahabad	Kasba Thana	DW	25.22	77.36	0.02	BDL	BDL	0.040	0.008	0.001
73	Bundi	Bundi	Delunda	DW	25.46	75.87	BDL	0.005	BDL	0	BDL	BDL
74	Bundi	Keshorai Patan	Dahi Khera	DW	25.59	76.09	BDL	0.005	BDL	0	BDL	0.002
75	Bundi	Keshorai Patan	Kapren	DW	25.41	76.08	BDL	0.005	0.015	0	BDL	0.004
76	Jaipur	Phagi	Parun	DW	26.49	75.60	0.06	0.005	BDL	0.197	0.010	0.005
77	Jhalawar	Bhawani Mandi	Ganeshpura	DW	24.48	75.96	BDL	BDL	0.015	0	BDL	0.006
78	Jhalawar	Khanpur	Piplaj	DW	24.70	76.41	0.01	BDL	BDL	0	0.008	0.001
79	Jhalawar	Khanpur	Mandawar1	DW	24.59	76.25	0.05	0.005	0.054	0	BDL	0.002
80	Kota	Ladpura	Girdharpura	DW	25.22	75.82	0.01	0.005	0.054	0.047	0.004	0.001

81	Kota	Sangod	Rajgarh1	DW	25.11	76.22	BDL	BDL	BDL	0.033	BDL	0.003
82	Sawai Madhopur	Khandar	Bodal	DW	25.93	76.43	BDL	0.005	BDL	0	BDL	0.004
83	Sawai Madhopur	Khandar	Chann	DW	25.91	76.47	BDL	BDL	BDL	0.01	BDL	0.001
84	Sawai Madhopur	Khandar	Hindwar	DW	25.89	76.35	BDL	BDL	BDL	0	BDL	0.004
85	Sawai Madhopur	Khandar	Khandar1	DW	26.01	76.60	BDL	0.010	BDL	0	BDL	0.002
86	Sawai Madhopur	Khandar	Kushlipura	DW	25.94	76.37	BDL	0.010	0.017	0	BDL	0.004
87	Sawai Madhopur	Khandar	Phariya	DW	25.91	76.52	0.67	0.005	0.020	0	BDL	0.001
88	Sawai Madhopur	Sawai Madhopur	Ranthambor	DW	26.02	76.46	BDL	0.010	0.019	0	BDL	0.001
89	Sawai Madhopur	Sawai Madhopur	Surwal	DW	26.10	76.36	0.03	BDL	0.011	0.097	0.006	0.001
90	Sawai Madhopur	Sawai Madhopur	Sawai Madhopur	DW	26.01	76.36	BDL	0.005	0.013	0	BDL	BDL
91	Tonk	Deoli	Bantholi	DW	25.88	75.56	BDL	BDL	BDL	0	BDL	0.002
92	Bikaner	Bikaner	Karmisar	DW	28.00	73.28	BDL	BDL	BDL	0	BDL	0.004
93	Bikaner	Bikaner	Khara	DW	28.20	73.39	BDL	BDL	BDL	0.070	BDL	0.005
94	Bikaner	Chhattargarh	Chhattargarh	DW	28.67	73.13	0.07	BDL	BDL	0.097	0.004	0.006
95	Bikaner	Dungargarh	Dungargarh	DW	28.08	74.01	BDL	BDL	BDL	0.133	BDL	0.001
96	Bikaner	Dungargarh	Lakhasar2	DW	28.10	73.87	BDL	BDL	BDL	0.070	BDL	0.002
97	Bikaner	Khajuwala	Khajuwala	DW	28.69	72.59	BDL	0.010	0.019	0	BDL	BDL
98	Bikaner	Khajuwala	Sattasar	DW	28.59	73.19	0.03	BDL	BDL	0	BDL	BDL
99	Bikaner	Lunkaransar	Binjawari	DW	28.47	73.45	0.06	BDL	0.011	0.227	BDL	0.001
100	Bikaner	Lunkaransar	Lakhansar	TW	28.87	73.35	BDL	BDL	0.020	0.090	BDL	
101	Bikaner	Lunkaransar	Lunkaransar	TW	28.49	73.75	BDL	BDL	BDL	0	BDL	0.001

102	Churu	Bidasar	Bamboo	DW	27.73	74.12	0.07	BDL	BDL	0	BDL	0.002
103	Churu	Bidasar	Bidasar	DW	27.84	74.28	0.07	BDL	0.075	0.172	BDL	0.002
104	Churu	Bidasar	Soniyasar	DW	27.76	74.02	BDL	BDL	0.039	0.199	BDL	BDL
105	Churu	Ratangarh	Bhojasar	DW	27.97	74.54	BDL	BDL	BDL	0.045	BDL	BDL
106	Churu	Ratangarh	Parihara	DW	27.92	74.56	BDL	BDL	BDL	0	BDL	BDL
107	Churu	Ratangarh	Ratangarh	DW	28.06	74.60	0.03	BDL	BDL	0.045	BDL	BDL
108	Churu	Ratangarh	Tidiyasar	TW	28.07	74.75	BDL	BDL	BDL	0.039	BDL	BDL
109	Jhunjhunu	Nawalgarh	Nawalgarh	DW	27.85	75.25	BDL	BDL	0.011	0.060	BDL	BDL
110	Sikar	Dantaramgarh	Ramgarh	DW	27.26	75.18	0.17	BDL	BDL	0.101	BDL	BDL
111	Sikar	Khandela	Khandela	DW	27.60	75.50	BDL	BDL	0.016	0.119	BDL	0.002
112	Churu	Churu	Binasar	DW	28.26	74.88	BDL	BDL	BDL	0	BDL	0.001
113	Churu	Churu	Rampura	DW	28.31	74.85	BDL	BDL	BDL	0.210	BDL	0.002
114	Churu	Churu	Sirsala	DW	28.43	75.13	0.03	BDL	BDL	0.095	BDL	0.003
115	Churu	Rajgarh	Dadrewa	DW	28.67	75.23	BDL	BDL	0.014	0.464	BDL	0.001
116	Churu	Sardar Sahar	Aspalsar	DW	28.58	74.50	BDL	0.003	BDL	0.057	BDL	BDL
117	Churu	Sardarshahar	Melusar	DW	28.50	74.74	BDL	BDL	0.022	0.591	BDL	BDL
118	Churu	Taranagar	Shawa	DW	28.88	74.84	BDL	0.075	0.040	0.269	BDL	BDL
119	Ganganagar	Anupgarh	Anupgarh1	DW	29.19	73.22	0.02	BDL	BDL	0.030	BDL	BDL
120	Ganganagar	Gharsana	Gharsana	DW	29.03	73.08	0.03	BDL	BDL	0	BDL	BDL
121	Ganganagar	Sadulshahar	Sadulshahar	HP	29.90	74.20	0.85	BDL	0.020	0.225	BDL	0.001
122	Hanumangarh	Bhadra	Bhadra	HP	29.12	75.16	BDL	BDL	BDL	0.033	BDL	0.001

123	Hanumangarh	Bhadra	Dungrana	DW	29.01	75.10	0.01	BDL	BDL	0.063	BDL	0.004
124	Hanumangarh	Bhadra	Munsari	DW	29.10	75.03	BDL	BDL	BDL	0	0.001	0.003
125	Hanumangarh	Hanumangarh	Chohlinyawali	DW	29.38	74.27	0.29	BDL	0.012	0.066	BDL	0.001
126	Hanumangarh	Hanumangarh	Dholipal	DW	29.76	74.27	0.03	0.109	0.021	0.032	BDL	BDL
127	Hanumangarh	Hanumangarh	Goluwala	TW	29.63	74.06	BDL	BDL	BDL	0	0.001	bdl
128	Hanumangarh	Hanumangarh	Kohla	DW	29.56	74.33	BDL	BDL	BDL	0	BDL	0.006
129	Hanumangarh	Hanumangarh	Pakkasarna	DW	29.68	74.16	BDL	BDL	BDL	0	BDL	0.002
130	Hanumangarh	Hanumangarh	Satipura	DW	29.63	74.32	0.02	BDL	BDL	0.072	BDL	0.003
131	Hanumangarh	Rawatsar	Purabsar	DW	29.03	74.28	0.07	BDL	0.010	0.222	BDL	0.001
132	Hanumangarh	Sangariya	Bolanwali	DW	29.84	74.41	0.01	BDL	0.015	0.052	BDL	BDL
133	Hanumangarh	Sangariya	Sangariya	DW	29.81	74.46	0.03	0.008	BDL	0.035	BDL	BDL
134	Barmer	Gadraroad	Gadra Road	TW	25.74	70.64	BDL	BDL	BDL	0	BDL	0.004
136	Barmer	Sheo	Gujrokabera	TW	26.20	71.33	BDL	BDL	BDL	0.066	BDL	BDL
137	Barmer	Shergarh	Kumarokidhani	DW	26.20	72.12	0.04	0.008	0.013	0.194	BDL	0.002
138	Jaisalmer	Jaisalmer	Moolsagar	TW	26.91	70.84	0.03	0.068	BDL	0	BDL	0.001
139	Jaisalmer	Jaisalmer	Chandan	TW	26.99	71.30	0.07	BDL	BDL	0.032	0.004	0.004
140	Jaisalmer	Jaisalmer	Ghantiyali	TW	27.45	71.46	BDL	BDL	BDL	0.01	BDL	0.003
141	Jaisalmer	Jaisalmer	Jaisalmer	TW	26.94	70.91	BDL	BDL	BDL	0.035	BDL	0.001
142	Jaisalmer	Sam	Gotaru	DW	27.32	70.04	0.02	0.005	BDL	0	BDL	BDL
143	Jaisalmer	Sam	Khariakua_Dw	TW	27.72	70.33	0.03	BDL	BDL	0.032	BDL	BDL
144	Jaisalmer	Sam	Kuria	TW	26.62	70.49	BDL	BDL	BDL	0	BDL	BDL

145	Jaisalmer	Sam	Nathu Ka Bera	TW	27.81	70.42	0.01	BDL	BDL	0	BDL	BDL
146	Jaisalmer	Sam	Tanot	DW	27.80	70.37	BDL	BDL	BDL	0	BDL	BDL
147	Jaisalmer	Sankra	Bhainsara	TW	26.63	71.49	BDL	BDL	BDL	0.062	BDL	0.001
148	Jaisalmer	Sankra	Lawan	DW	26.87	72.05	BDL	BDL	BDL	0	BDL	0.002
149	Jaisalmer	Sankra	Luna Kalan	HP	26.62	71.57	0.46	BDL	BDL	0.734	BDL	0.004
150	Jaisalmer	Sankra	Sribhadria	TW	27.08	71.55	BDL	BDL	BDL	0.062	BDL	0.003
151	Jodhpur	Bap	Bap	DW	27.36	72.35	0.10	BDL	BDL	0.047	0.005	0.001
152	Jodhpur	Bap	Nokhracharna	TW	27.23	72.89	BDL	0.004	BDL	0.061	BDL	BDL
153	Jodhpur	Dechu	Dechupz	TW	26.77	72.33	BDL	BDL	BDL	0	BDL	bdl
154	Jodhpur	Phalodi	Kolu	TW	26.55	72.18	BDL	BDL	BDL	0.100	BDL	0.002
155	Jodhpur	Shergarh	Nahar Singh Nagar	TW	26.39	72.29	0.08	BDL	BDL	0.061	BDL	0.001
156	Jodhpur	Shergarh	Shergarh	TW	26.32	72.28	BDL	BDL	BDL	0	BDL	0.003
157	Barmer	Baitu	Bhadka	TW	26.01	71.37	0.35	BDL	BDL	0.051	BDL	0.001
158	Barmer	Baitu	Kerala	TW	26.00	71.90	BDL	BDL	0.010	0	BDL	BDL
160	Barmer	Baitu	Sawau Padam Singh	TW	26.19	71.81	0.08	BDL	BDL	0.061	BDL	BDL
161	Barmer	Chauhtan	Siyagatala	DW	25.47	70.85	BDL	BDL	BDL	0.047	BDL	BDL
162	Barmer	Serwa	Sedwa	TW	25.07	71.13	BDL	BDL	BDL	0	BDL	0.002
164	Barmer	Sindhri	Khara Mahecha	TW	25.51	72.03	0.03	0.055	BDL	0.047	BDL	0.001
165	Jalore	Bhinmal	Khanpur	TW	25.03	72.35	BDL	0.089	0.014	0.065	BDL	0.003
166	Jalore	Bhinmal	Narta	TW	25.09	72.27	BDL	0.055	BDL	0.033	0.003	0.001
167	Jalore	Chitalwana	Doongri	DW	24.94	71.41	BDL	BDL	BDL	0.054	BDL	BDL

168	Jalore	Chitalwana	Halivav	TW	24.99	71.59	BDL	BDL	BDL	0	BDL	BDL
169	Jalore	Jalore	Bhagli	TW	25.28	72.60	0.19	0.140	0.019	0.114	0.002	0.001
170	Pali	Marwar Junction	Marwar Junction Block Hq	TW	25.72	73.60	BDL	BDL	BDL	0	BDL	BDL
171	Pali	Pali	Gundoj	HP	25.61	73.31	BDL	BDL	BDL	0	BDL	BDL
172	Sirohi	Pindwara	Sarupganj	DW	24.66	72.94	BDL	BDL	BDL	0	BDL	0.001
173	Sirohi	Pindwara	Virwara	HP	24.84	72.99	BDL	BDL	BDL	0	BDL	0.001
175	Sirohi	Sirohi	Mera Kishangarh	HP	24.77	72.74	0.56	BDL	0.012	0.170	BDL	0.003
176	Barmer	Balotra	Balotra	tw	25.82	72.24	BDL	BDL	0.021	0.130	BDL	0.001
177	Barmer	Samdari	Karmawas	TW	25.79	72.59	BDL	BDL	BDL	0	BDL	BDL
178	Jodhpur	Bawari	Soyla	TW	26.83	73.34	0.02	BDL	BDL	0.127	BDL	BDL
179	Jodhpur	Bhopalgarh	Bhopalgarh Block Hq	TW	26.65	73.50	BDL	BDL	BDL	0	BDL	0.001
180	Jodhpur	Bhopalgarh	Kumhara	TW	26.74	73.54	0.03	BDL	BDL	0.078	BDL	0.001
181	Jodhpur	Bhopalgarh	Sargiya Kallan	TW	26.54	73.54	BDL	BDL	BDL	0.094	BDL	0.001
182	Jodhpur	Bilara	Binawas Uranium Hotspot	HP	26.28	73.38	0.45	0.078	0.060	0.215	BDL	0.004
183	Jodhpur	Bilara	Borunda	TW	26.47	73.80	0.14	0.008	BDL	0.042	BDL	0.001
184	Jodhpur	Bilara	Olvi	TW	26.20	73.44	BDL	BDL	BDL	0.035	BDL	0.004
185	Jodhpur	Mandor	Bisalpur	DW	26.22	73.31	0.01	0.078	BDL	0.215	BDL	0.003
186	Jodhpur	Mandore	Dangiyawas	DW	26.26	73.28	BDL	0.008	BDL	0.084	BDL	0.001
187	Jodhpur	Pipad City	Pipad City	TW	26.40	73.53	0.01	0.010	BDL	0.01	BDL	BDL
188	Nagaur	Datau	Datau	TW	27.49	74.46	BDL	0.008	BDL	0	BDL	BDL
189	Nagaur	Didwana	Raghunathpura	DW	27.37	74.51	BDL	0.006	BDL	0	BDL	0.004

190	Nagaur	Didwana	Singhana	DW	27.48	74.51	0.02	0.065	BDL	0	BDL	BDL
191	Nagaur	Kuchaman City	Kuchaman Block Hq	DW	27.16	74.85	BDL	BDL	BDL	0.032	BDL	BDL
192	Nagaur	Ladnu	Ladnu Block Hq	TW	27.62	74.38	BDL	0.008	BDL	0.032	BDL	0.001
193	Nagaur	Ladnu	Sanward	DW	27.52	74.49	0.08	0.010	0.014	0.038	BDL	0.001
194	Nagaur	Nawa	Nawa	TW	27.04	74.96	BDL	0.008	BDL	0.035	BDL	0.004
195	Pali	Sojat	Sojat Block Hq	TW	25.91	73.66	BDL	BDL	BDL	0	BDL	0.003
196	Bhilwara	Kotri	Sawaipur	DW	25.31	74.87	0.08	0.008	0.103	0.219	BDL	0.001
197	Bhilwara	Raipur	Nangpura	DW	25.45	74.19	0.63	0.009	0.132	0.399	BDL	BDL
198	Bhilwara	Raipur	Raipur	DW	25.40	74.16	BDL	BDL	0.020	1.291	BDL	BDL
199	Bhilwara	Sahara	Potlan	DW	25.14	74.22	0.74	BDL	0.065	1.491	BDL	BDL
201	Chittaurgarh	Chittaurgarh	Bojunda	DW	24.85	74.59	0.37	0.010	0.087	1.442	BDL	0.001
202	Chittaurgarh	Chittaurgarh	Manpura2	DW	24.91	74.64	0.06	0.008	BDL	0.142	BDL	0.001
203	Chittaurgarh	Chittaurgarh	Nagari1	TW	24.95	74.69	0.08	BDL	0.042	0.469	BDL	0.001
204	Chittaurgarh	Chittaurgarh	Purohitokasavat	DW	24.94	74.52	BDL	BDL	0.127	0.076	BDL	BDL
205	Chittaurgarh	Kapasan	Kapasan1	DW	24.86	74.31	0.06	0.008	0.085	0.138	BDL	0.002
206	Rajsamand	Amet	Gugli	DW	25.23	73.88	BDL	0.008	BDL	0	BDL	0.004
207	Rajsamand	Railmagra	Oda 1	DW	25.03	74.00	BDL	0.007	BDL	0	BDL	0.005
208	Rajsamand	Amet	Amet	DW	25.30	73.92	0.07	0.010	BDL	0.061	BDL	0.006
209	Rajsamand	Rajsamand	Mokampura	DW	25.13	73.85	0.08	BDL	0.025	0.113	BDL	0.001
210	Rajsamand	Rajsamand	Rajsamand	DW	25.07	73.88	0.02	BDL	0.058	0.116	BDL	0.002
212	Udaipur	Mavli	Mavli1	DW	24.78	73.98	BDL	BDL	BDL	0	BDL	BDL

214	Udaipur	Mavli	Bhoyana	DW	24.72	73.92	BDL	BDL	0.018	0.186	BDL	0.001
215	Udaipur	Sayra	Sayra	DW	24.98	73.42	BDL	BDL	0.030	0	BDL	0.004
216	Alwar	Behror	Sota Nala	DW	27.83	76.26	BDL	BDL	BDL	0.032	BDL	0.002
217	Alwar	Neemrana	Majri Khurd	DW	27.98	76.38	0.15	BDL	BDL	0	BDL	BDL
218	Alwar	Thanagazi	Bairawas	DW	27.46	76.40	0.01	BDL	BDL	0.094	BDL	0.001
219	Jaipur	Amer	Chaump	DW	27.10	75.83	0.07	BDL	BDL	0	BDL	0.001
220	Jaipur	Amer	Rajarampura	DW	27.09	75.55	BDL	BDL	BDL	0.054	BDL	0.001
221	Jaipur	Bassi	Bassi2	DW	27.31	75.94	0.01	BDL	0.010	0.032	BDL	BDL
222	Jaipur	Govindgarh	Kanarpura	DW	27.19	75.57	0.01	BDL	BDL	0	BDL	0.002
223	Jaipur	Govindgarh	Alisar	DW	27.23	75.58	0.02	BDL	BDL	0.032	0.001	0.004
224	Jaipur	Govindgarh	Astikalan	DW	27.27	75.51	0.02	BDL	BDL	0.036	BDL	BDL
225	Jaipur	Govindgarh	Dhodsar	DW	27.31	75.62	BDL	BDL	BDL	0	BDL	BDL
226	Jaipur	Govindgarh	Kaladera2	DW	27.18	75.62	BDL	BDL	BDL	0.047	BDL	0.001
227	Jaipur	Govindgarh	Niwana	DW	27.28	75.73	BDL	BDL	BDL	0.043	BDL	0.001
228	Jaipur	Govindgarh	Tigaria	DW	27.29	75.78	BDL	BDL	BDL	0	BDL	0.004
229	Jaipur	Paota	Paota	DW	27.58	76.08	0.03	BDL	BDL	0.120	BDL	0.003
230	Jhunjhunu	Chirawa	Mandrela	DW	28.30	75.45	BDL	BDL	BDL	0.036	BDL	0.001
231	Sikar	Neem Ka Thana	Barala	HP	27.76	75.88	0.50	BDL	0.015	1.986	BDL	BDL
232	Sikar	Patan	Patan	DW	27.79	75.98	0.02	0.010	0.016	0.102	BDL	BDL

Water Quality index for water samples collected in 2023 **AnnexureVII**

Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI
4U/1	124.66	4U/32	91.22	5U/21	21.69	8U/14	57.20	8U/45	110.20	9U/29	87.18	11U/12	92.70
4U/2	90.61	4U/33	151.04	5U/22	58.17	8U/15	213.37	8U/46	198.92	9U/30	36.42	11U/13	101.23
4U/3	73.66	4U/34	69.34	5U/23	24.83	8U/16	750.05	8U/47	127.66	9U/31	37.72	11U/14	213.36
4U/4	76.94	4U/35	37.13	5U/24	33.58	8U/17	135.78	9U/1	62.77	9U/32	263.32	11U/15	17.22
4U/5	131.62	4U/36	89.37	5U/25	26.17	8U/18	113.26	9U/2	39.27	9U/33	333.84	11U/16	57.39
4U/6	31.39	4U/37	45.80	5U/26	59.12	8U/19	55.57	9U/3	93.46	9U/34	45.77	11U/17	49.82
4U/7	30.89	4U/38	16.76	5U/27	68.01	8U/20	797.38	9U/4	49.53	9U/35	50.26	11U/18	60.17
4U/8	34.10	4U/39	231.25	5U/28	33.16	8U/21	394.44	9U/5	99.84	9U/36	55.36	11U/19	146.77
4U/9	25.53	4U/40	35.29	6U/1	156.60	8U/22	151.38	9U/6	96.99	9U/37	35.22	11U/20	51.59
4U/10	33.31	4U/41	61.78	6U/2	301.04	8U/23	39.34	9U/7	235.11	9U/38	72.87	11U/21	125.50
4U/11	141.42	4U/42	46.31	6U/3	178.91	8U/24	101.80	9U/8	91.93	9U/39	43.15	11U/22	92.84
4U/12	42.62	5U/1	136.38	6U/4	165.98	8U/25	292.70	9U/9	39.07	9U/40	34.41	11U/23	258.15
4U/13	90.85	5U/2	47.28	6U/5	267.17	8U/26	66.31	9U/10	744.20	9U/41	67.32	11U/24	92.99
4U/14	86.06	5U/3	18.58	6U/6	160.85	8U/27	74.62	9U/11	68.32	9U/42	100.06	11U/25	47.26
4U/15	73.94	5U/4	39.99	6U/7	138.19	8U/28	60.89	9U/12	462.09	9U/43	897.80	11U/26	335.37
4U/16	58.59	5U/5	125.71	6U/8	215.52	8U/29	107.66	9U/13	207.52	9U/44	123.91	11U/27	142.07
4U/17	64.86	5U/6	96.37	6U/9	137.69	8U/30	113.21	9U/14	511.35	9U/45	114.16	11U/28	40.80
4U/18	157.71	5U/7	83.09	6U/10	90.22	8U/31	15.00	9U/15	274.54	9U/46	79.63	11U/29	141.24

Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI
4U/19	107.25	5U/8	20.67	8U/1	61.22	8U/32	183.27	9U/16	76.56	9U/47	156.52	11U/30	134.48
4U/20	23.14	5U/9	20.65	8U/2	117.67	8U/33	142.94	9U/17	117.05	9U/48	79.25	11U/31	230.60
4U/21	34.34	5U/10	27.19	8U/3	126.38	8U/34	55.39	9U/18	89.05	11U/1	74.62	11U/32	18.35
4U/22	53.73	5U/11	42.95	8U/4	78.78	8U/35	168.95	9U/19	485.62	11U/2	92.60	11U/33	115.99
4U/23	121.62	5U/12	55.96	8U/5	157.81	8U/36	157.33	9U/20	77.08	11U/3	25.27	11U/34	75.49
4U/24	157.97	5U/13	41.22	8U/6	84.33	8U/37	74.10	9U/21	178.21	11U/4	74.53	11U/35	186.39
4U/25	61.06	5U/14	37.07	8U/7	183.53	8U/38	100.50	9U/22	51.44	11U/5	197.43	11U/36	79.70
4U/26	124.32	5U/15	33.60	8U/8	534.06	8U/39	54.68	9U/23	105.04	11U/6	132.53	11U/37	31.01
4U/27	102.44	5U/16	265.23	8U/9	17.55	8U/40	143.62	9U/24	193.38	11U/7	228.44	11U/38	128.37
4U/28	221.53	5U/17	45.05	8U/10	101.98	8U/41	136.16	9U/25	30.33	11U/8	50.19	11U/39	51.05
4U/29	75.57	5U/18	22.39	8U/11	38.93	8U/42	74.16	9U/26	80.27	11U/9	98.01	11U/40	242.96
4U/30	68.95	5U/19	35.07	8U/12	525.87	8U/43	53.45	9U/27	44.42	11U/10	85.29	11U/41	242.43
4U/31	30.31	5U/20	22.00	8U/13	457.16	8U/44	107.01	9U/28	105.53	11U/11	59.35	11U/42	164.21
11U/43	213.48	12U/31	57.94	17U/32	93.04	20U/14	174.79	20U/47	113.28	30U/7	129.46	30U/40	122.09
11U/44	264.59	12U/32	188.11	17U/33	91.72	20U/15	196.76	20U/48	81.44	30U/8	175.96	30U/41	103.74
11U/45	184.82	17U/1	88.72	17U/34	213.04	20U/16	174.67	20U/49	136.59	30U/9	122.33	30U/42	137.05
12U/1	44.79	17U/2	110.67	17U/35	35.34	20U/17	121.01	20U/50	157.90	30U/10	139.95	30U/43	95.43
12U/2	118.39	17U/3	66.60	17U/36	152.23	20U/18	56.18	20U/51	153.04	30U/11	92.47	30U/44	102.26
12U/3	109.43	17U/4	29.53	17U/37	49.90	20U/19	62.38	20U/52	274.70	30U/12	68.06	30U/45	56.72

Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI
12U/4	42.30	17U/5	159.36	17U/38	29.49	20U/20	77.52	20U/53	137.71	30U/13	86.70	30U/46	81.58
12U/5	80.68	17U/6	198.93	17U/39	50.60	20U/21	40.76	20U/54	103.10	30U/14	63.48	30U/47	93.63
12U/6	165.10	17U/7	147.92	17U/40	78.52	20U/22	67.01	20U/55	56.75	30U/15	63.34	30U/48	77.75
12U/7	81.24	17U/8	85.49	17U/41	61.27	20U/23	50.81	20U/56	28.66	30U/16	83.79	30U/49	80.06
12U/8	105.04	17U/9	85.23	17U/42	75.42	20U/24	39.71	20U/57	124.28	30U/17	70.18	30U/50	80.42
12U/9	47.20	17U/10	130.55	17U/43	78.56	20U/25	76.80	21U/1	28.54	30U/18	129.11	30U/51	99.40
12U/10	54.20	17U/11	94.09	17U/44	112.55	20U/26	52.47	21U/2	605.55	30U/19	82.54	32U/1	248.87
12U/11	43.06	17U/12	29.45	17U/45	29.91	20U/27	40.55	21U/3	81.89	30U/20	107.62	32U/2	177.38
12U/12	160.14	17U/13	132.36	17U/46	207.04	20U/28	51.18	21U/4	136.02	30U/21	68.39	32U/3	69.72
12U/13	141.46	17U/14	323.53	17U/47	120.41	20U/29	63.19	21U/5	905.84	30U/22	102.87	32U/4	111.70
12U/14	73.81	17U/15	102.71	17U/48	46.79	20U/30	186.80	21U/6	42.27	30U/23	359.72	32U/5	99.31
12U/15	86.29	17U/16	152.63	17U/49	26.92	20U/31	73.21	21U/7	60.28	30U/24	135.90	32U/6	234.67
12U/16	36.61	17U/17	33.74	17U/50	64.90	20U/32	75.81	21U/8	104.82	30U/25	173.74	32U/7	100.03
12U/17	76.19	17U/18	60.10	17U/51	54.19	20U/33	47.25	21U/9	95.13	30U/26	178.98	32U/8	32.99
12U/18	45.33	17U/19	54.85	20U/1	80.38	20U/34	118.13	21U/10	192.62	30U/27	70.41	32U/9	66.89
12U/19	127.47	17U/20	34.15	20U/2	72.28	20U/35	214.61	21U/11	124.00	30U/28	238.04	32U/10	282.24
12U/20	41.96	17U/21	47.07	20U/3	66.26	20U/36	50.30	21U/12	95.98	30U/29	66.58	32U/11	54.13
12U/21	103.63	17U/22	102.78	20U/4	68.26	20U/37	97.60	21U/13	98.86	30U/30	162.29	32U/12	110.78
12U/22	19.48	17U/23	30.63	20U/5	56.87	20U/38	80.31	21U/14	125.90	30U/31	123.58	32U/13	48.05

Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI
12U/23	32.02	17U/24	41.73	20U/6	74.50	20U/39	293.30	21U/15	110.45	30U/32	103.36	32U/14	189.61
12U/24	40.88	17U/25	34.14	20U/7	50.55	20U/40	74.42	21U/16	49.35	30U/33	119.84	32U/15	179.39
12U/25	47.26	17U/26	45.76	20U/8	167.32	20U/41	94.84	30U/1	53.46	30U/34	91.51	32U/16	186.07
12U/26	32.56	17U/27	27.67	20U/9	62.10	20U/42	126.05	30U/2	98.40	30U/35	107.58	32U/17	89.55
12U/27	54.91	17U/28	493.95	20U/10	58.92	20U/43	91.29	30U/3	82.86	30U/36	132.63	32U/18	131.27
12U/28	53.02	17U/29	72.97	20U/11	93.47	20U/44	63.73	30U/4	90.11	30U/37	127.22	32U/19	55.97
12U/29	155.94	17U/30	86.70	20U/12	74.38	20U/45	59.19	30U/5	82.12	30U/38	136.38	32U/20	144.53
12U/30	160.57	17U/31	81.36	20U/13	102.00	20U/46	78.86	30U/6	106.75	30U/39	208.80	32U/21	60.12
32U/22	169.42	32U/53	95.55	32U/84	65.09	43U/27	133.97	43U/58	104.59	43U/89	28.13	32U/83	119.83
32U/23	238.73	32U/54	101.45	32U/85	241.32	43U/28	146.92	43U/59	66.53	43U/90	493.60	43U/57	140.58
32U/24	68.15	32U/55	110.31	32U/86	470.73	43U/29	102.69	43U/60	132.92	43U/91	300.03		
32U/25	79.68	32U/56	97.95	32U/87	379.85	43U/30	843.52	43U/61	103.79	43U/92	351.44		
32U/26	260.85	32U/57	101.92	32U/88	249.93	43U/31	105.37	43U/62	76.80	43U/93	65.21		
32U/27	436.23	32U/58	51.78	43U/1	210.44	43U/32	504.58	43U/63	102.92	43U/94	109.02		
32U/28	176.03	32U/59	56.80	43U/2	161.85	43U/33	256.30	43U/64	91.59	43U/95	69.14		
32U/29	234.50	32U/60	54.91	43U/3	27.88	43U/34	184.98	43U/65	120.08	43U/96	80.06		
32U/30	208.08	32U/61	70.57	43U/4	339.67	43U/35	861.07	43U/66	122.53	43U/97	142.50		
32U/31	203.73	32U/62	44.85	43U/5	218.10	43U/36	141.70	43U/67	110.58	43U/98	206.23		
32U/32	202.57	32U/63	83.45	43U/6	110.78	43U/37	805.97	43U/68	128.24	43U/99	215.43		

Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI	Sr. No.	WQI
32U/33	113.69	32U/64	120.50	43U/7	528.94	43U/38	465.49	43U/69	180.36	43U/100	91.00		
32U/34	36.68	32U/65	204.96	43U/8	118.06	43U/39	86.37	43U/70	174.44	43U/101	151.55		
32U/35	153.38	32U/66	135.85	43U/9	220.13	43U/40	112.41	43U/71	175.14	43U/102	143.48		
32U/36	88.28	32U/67	121.04	43U/10	73.43	43U/41	204.88	43U/72	188.27	43U/103	216.67		
32U/37	149.27	32U/68	88.12	43U/11	117.41	43U/42	533.85	43U/73	554.08	43U/104	101.45		
32U/38	176.94	32U/69	97.45	43U/12	118.93	43U/43	396.48	43U/74	574.36	43U/105	97.58		
32U/39	67.88	32U/70	126.19	43U/13	36.63	43U/44	160.56	43U/75	682.42	43U/106	150.44		
32U/40	384.58	32U/71	296.70	43U/14	88.10	43U/45	189.22	43U/76	93.93	43U/107	64.17		
32U/41	69.60	32U/72	55.02	43U/15	36.59	43U/46	277.21	43U/77	37.95	43U/108	52.31		
32U/42	198.28	32U/73	108.82	43U/16	124.73	43U/47	155.81	43U/78	217.09	43U/109	44.23		
32U/43	48.87	32U/74	57.03	43U/17	251.56	43U/48	84.02	43U/79	308.00	43U/110	72.09		
32U/44	92.55	32U/75	81.53	43U/18	653.19	43U/49	98.13	43U/80	285.29	43U/111	293.32		
32U/45	70.77	32U/76	566.82	43U/19	146.86	43U/50	92.52	43U/81	84.76	43U/112	80.47		
32U/46	125.33	32U/77	142.06	43U/20	282.68	43U/51	101.19	43U/82	132.39	43U/113	64.82		
32U/47	152.02	32U/78	89.16	43U/21	131.80	43U/52	175.77	43U/83	116.30	43U/114	90.30		
32U/48	130.30	32U/79	31.10	43U/22	116.54	43U/53	165.05	43U/84	445.96	43U/115	41.03		
32U/49	92.35	32U/80	38.27	43U/23	121.01	43U/54	257.74	43U/85	303.05	32U/52	93.59		
32U/50	80.53	32U/81	82.94	43U/24	155.38	43U/55	176.17	43U/86	379.83	43U/26	109.34		
32U/51	148.46	32U/82	103.89	43U/25	94.21	43U/56	308.26	43U/87	308.92	43U/88	163.46		