केन्द्रीय भूमि जल बोर्ड
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भारत सरकार
Central Ground Water Board
Department of Water Resources, River
Development and Ganga Rejuvenation,
Ministry of Jal Shakti
Government of India

AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

CHURU DISTRICT
RAJASTHAN

पश्चिमी क्षेत्र, जयपुर
Western Region, Jaipur

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Draft Report

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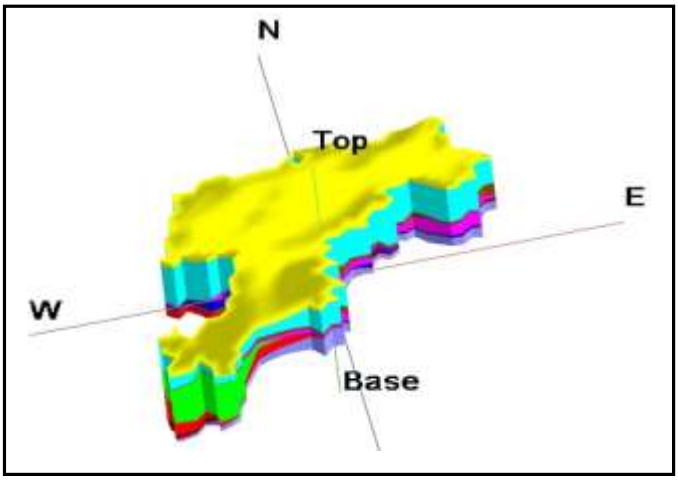
AQUIFER MAPPING AND GROUNDWATER MANAGEMENT PLAN CHURU DISTRICT, RAJASTHAN



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Report On

AQUIFER MAPPING AND GROUND WATER MANAGEMENT PLAN CHURU DISTRICT, RAJASTHAN

(13793 sq. km.)

AAP 2021-22

By -

Prashant Shrivas

Under The Supervision Of –

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पश्चिमी क्षेत्र, जयपुर

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1. District at a Glance

Salient Information	District Name	Churu	
	Longitude	73° 52′ 40″ to 75° 40′ 30″ East	
	Latitude	27° 25′ 10″ to 28° 59′ 20″ North	
	Geographical Area sq. km.	13,793	
	Hilly Area (sq. km.)	0.00	
	Population (2011)	2,039,547	
	Highest Elevation (m amsl)	470.7	
	Lowest Elevation (m amsl)	199.2	
	General Elevation (m amsl)	500-625	
Climate	Average Temperature Range (°C) (Year 2020)	Maximum: 47.33° to 50.2° C	
		Minimum: -0.6° to 2.1° C	
Rainfall Analysis	Normal Rainfall (mm) (1901-1970)	575.0	
	Mean Annual Rainfall (mm) (1991-2020)	406.4	
	Highest Annual Rainfall (mm) (1991-2020)	660.3 (2011)	
	Lowest Annual Rainfall (mm) (1991-2020)	162.2 (2002)	
	Standard Deviation (mm) (1991-2020)	118.4	
	Coefficient of Variation (%) (1991-2020)	29.1	
Drought Analysis(1991-2020)		**No. of Years of Drought**	**Frequency %**
	No Drought	13	43.33%
	Mild (0 to -25%)	10	33.33 %
	Moderate (-25% to -50%)	6	20 %
	Severe (-50% to -75%)	1	3.33%
	Extreme (-75% to -100%)	-	-

Geomorphology	• Buried Pediments of Denudational Origin and pediments covers essentially with relatively thicker alluvial, colluvial or weathered materials. • Dune valley complex, Eolian Plain, Interdunal Depressions and Sandy plain of Aeolian Origin. • Alluvial plain of Fluvial Origin	
Geology	• Alluvium consisting of Sand, Silt and Clay alternating beds of Recent to Sub-Recent age. • Marwar Super Group which consists of sandstone, shale and limestone is divided into Nagaur Group, Bilara Group and Jodhpur Group exposed in the southern part of the district. • Delhi Super Group which consist of Schist and Quartzite which is exposed in the Southern boundary of the district with intrusions of Erinpura Granite.	
Drainage & Hydrology	Drainage **Basin/Sub-Basin**	No major river system except Kantli river running in some part of district.
Land Use	Geographical Area (sq. km.)	13793
	Forest Area (sq. km.)	65.23
	Net Sown Area (sq. km.)	1762.70
	Area sown more than once (sq. km.)	2788.03
Irrigation	Gross Irrigated Area by Surface Water (sq. km.)	227.91
	Gross Irrigated Area by Ground Water (sq. km.)	2711.19
	Gross Irrigated Area by all sources (sq. km.)	2929.10

Agriculture	Rain-fed Crop	Jowar, Bajra, Maize, Cotton, Til, Pulses and Ground Nut		
	Irrigated Crop	Wheat, Barley, Gram, Mustard, Pulses, Green Peas.		
		Kharif	**Rabi**	**Zaid Rabi**
	Gross Sown Area (sq. km.)	11066.80	2721.84	2.23
	Irrigated (sq. km.)	947.16	1989.72	2.23
Hydrogeology				
Monitoring Stations (May 2021)	CGWB	27		
	SGWD	99		
	NAQUIM Key Wells	103		
Water Level Behavior		**Pre-Monsoon (May-2021)**	**Post- Monsoon (November-2021)**	
	Water Level (m bgl)	8.04 (Bidasar) – 127.2 (Dhani Kumharan)	7.81 (Bidasar)- 127.1 (Dhani Kumharan)	
	Water Level Trend (2011-2020)	**Pre-Monsoon**	**Post- Monsoon**	
	Rise	0.01 – 7.32	0.01 – 8.56	
	Fall	0.00 – 16.48	0.00 – 16.12	
Aquifer Disposition	Number of Aquifers (Major)	ONE		
	Number of Zones	ONE		
	I	Sand-1		
Status of GW Exploration	**CGWB**	**GWD**		
	84	158		

Chemical Quality of Groundwater	**Electrical Conductivity µS/cm at 25°C**				400 - 20560
	pH				7.03 – 8.53
	Suitability for Drinking	**TDS**	**Range (mg/l)**	**Class**	**% Samples**
			< 500	Desirable	2.12 %
			500 - 2000	Permissible	39.00 %
			> 2000	Undesirable	58.86 %
		Hardness	**Range (mg/l)**	**Class**	**% Samples**
			0 – 75	Soft	0.0 %
			75 – 150	Moderately Hard	5.67 %
			150 – 300	Hard	26.24 %
			> 300	Very Hard	68.08 %
		NO_3 in mg/l	(> 45 mg/l) Permissible Limit		69.50 %
		F in mg/l	(> 1.5 mg/l) Permissible Limit		34.04 %
		U in µg/l	(> 30 µg/l) Permissible Limit		31.45 %
	Suitability for Irrigation	**Parameter**	**Range**	**Groundwater Class (Irrigation Uses)**	**% Samples**
		Salinity Hazard	< 250	Excellent	0.0 %
			250 - 750	Good	2.12 %
			750 - 2250	Permissible	24.11 %
			2250 - 3000	Doubtful	14.18 %
			> 3000	Unsuitable	59.60 %
		SAR	< 10	Excellent	43.9 %
			10 - 18	Good	31.9 %
			18 - 26	Fair	13.4%
			> 26	Unsuitable	10.63%

		Na%	< 20	Excellent	0%
			20 - 40	Good	15.65%
			40 - 60	Permissible	27.60 %
			60 - 80	Doubtful	44.60 %
			> 80	Unsuitable	23.40 %
		Residual Sodium Carbonate (RSC)	< 1.25	Safe	70.9 %
			1.25 - 2.5	Marginal	8.5 %
			> 2.5	Unsuitable	20.5 %
Groundwater Issues	• District has more abstraction of the groundwater resources than its availability and is categorized as Over Exploited with stage of development being 115.49 %. • Frequent Droughts is one of the issues with the frequency being nearly 56 % in the last 30 years, i.e., every alternate year is a drought year. • Limited potential zone area and sub-surface space available for storage of groundwater is a major issue as the entire district is covered up by the saline formations. • Quality of Groundwater is also an issue in the district, as nearly 68.08 % of the samples examined falls into the Very Hard category of Total Hardness classes. F is also on the higher side in about 34.04 % of the samples.			
Groundwater Resource & Extraction (GWRE-2020)	Ground Water Recharge Worthy Area (sq. km.)				13793
	Total Annual Ground Water Recharge (mcm)				129.01
	Natural Discharge (mcm)				12.90
	Net Annual Ground Water Availability (mcm)				116.11
	Existing Gross Ground Water Draft for All uses (mcm)				134.10
	Net ground water availability for future irrigation Development (mcm)				0.00
	Stage of Ground Water Development %				115.49
	Category				OE

Supply Side Management	**Water Supply (mcm)**	
	Potential zone area (sq. km.)	5191.8
	Volume of Sub surface Storage Space available for Artificial Recharge (mcm)	4590.38
	Surplus Surface water Availability (mcm)	0
	Water Conservation Structures	
	Number of Tanka Structures	25592
Demand Side Management	**Micro irrigation techniques (Use of Sprinklers)**	
	Irrigation Area proposed for irrigation through Sprinkler (sq. km.)	604.50
	Water Saving by use of Sprinklers (mcm)	48.38
	Cropping Pattern change	
	Cropping Area (sq.km.) proposed for change in crop	33.21
	Water Saving by Change in Cropping Pattern	3.32
Expected Benefits	Net Ground Water Availability (mcm) 2020	116.11
	Additional GW resources available after Supply side interventions (mcm)	0.00
	Net Ground Water Availability after Supply side intervention (mcm)	116.11
	Existing Ground Water Draft for All Purposes (mcm)	134.10
	GW draft after Supply Side Interventions (mcm)	132.82
	GW draft after Demand Side Interventions (mcm)	81.28
	Present stage of Ground Water Development (%)	**115.49 %**
	Projected Stage of Ground Water Development after Supply Side interventions (%)	**114.39 %**
	Projected Stage of Ground Water Development after Demand Side interventions (%)	**70.00%**

2. Introduction

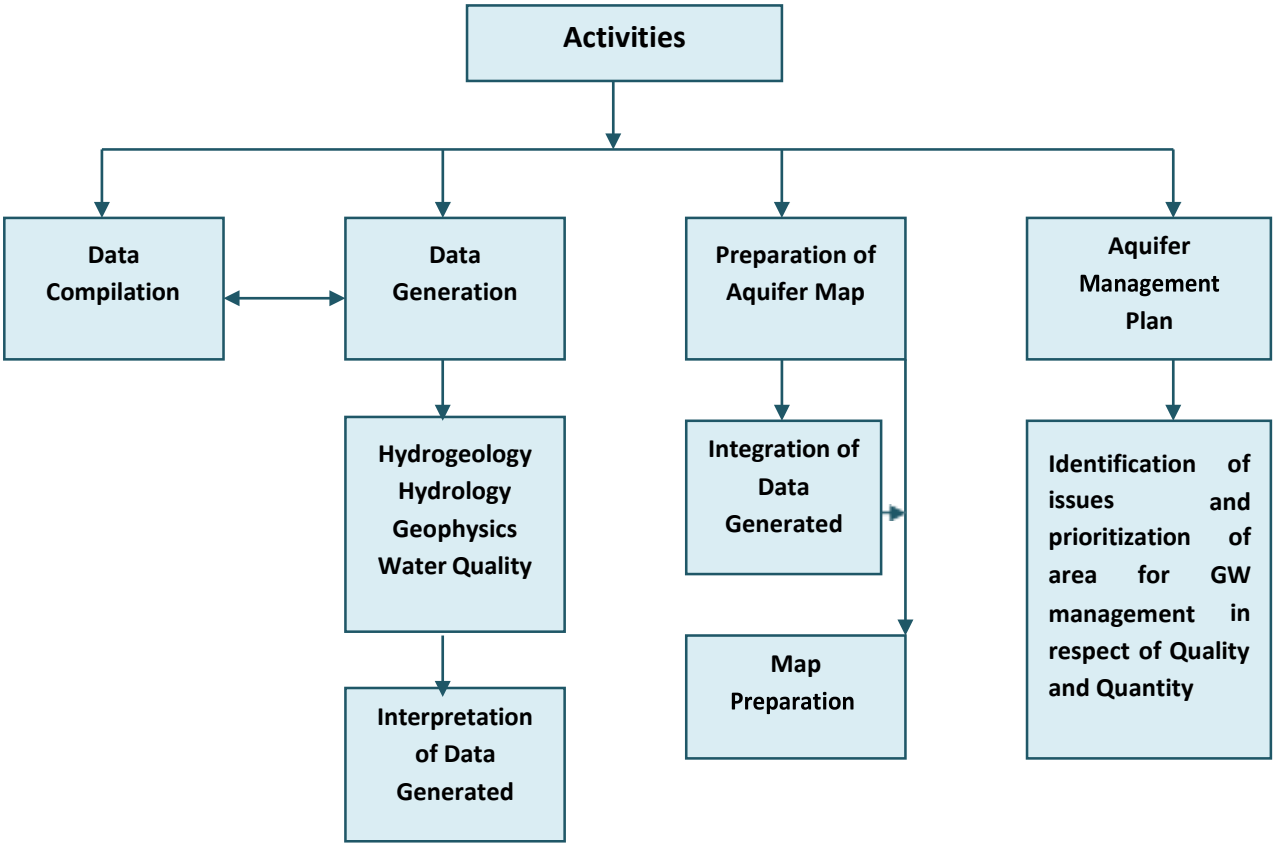
The utilization of groundwater for domestic, livestock and irrigation purposes has been constantly increasing in the arid districts of Rajasthan, especially because of the absence of perennial surface water sources over most part and a rapid growth of human and livestock population which are largely dependent on groundwater for their survival. Because of the increasing trend of groundwater exploitation, it has become necessary to assess the quantity and quality of usable water from different aquifer systems in the region. Groundwater is a precious natural waterresource considered as a readily available and safe source of water for domestic, agriculture and industrial uses. Our growing dependability on ground water has started diminishing this resource. The most significant change in the groundwater scenario in India is that the share of bore well irrigation went up from a mere 1 percent during 1960-61 to 60 percent during 2006-07 as per Indian Agricultural Statistic, 2008. About 85% of the rural drinking water supply is also met from ground water sources. Thus, a need was felt for scientific management of groundwater resources and the need has turned to urgency in the present times. There has been a paradigm shift from groundwater development to groundwater management over the last decade. The importance of groundwater for national development has deemed it necessary to be more specific; more general "groundwater management" has become "aquifer management" to answer the specific queries on availability and sustainability. CGWB has taken up National Project on Aquifer Management (NAQUIM) in XII & XIII Plan period to formulate sustainable aquifer management plan.

2.1. Objective

The broad objective of the study is to establish the geometry of the underlying aquifer systems in horizontal and vertical domain and characterize them, so as to work out the development potential and prepare block wise management plan. It is envisaged to assess the aquifer wise availability, utilization and water quality, especially in problematic/vulnerable area. Finally, the aim of this study is to prepare block wise management plan to facilitate the suitable development and management of ground water resources.

2.2. Approach & Methodology

As mentioned above, aquifer mapping is an attempt to integrate the geological, Geophysical, hydrological and chemical field and laboratory analyses are applied to characterize the quality, quantity and sustainability of groundwater in aquifer. Under the National aquifer Program, it is proposed to generate Aquifer maps on 1:50000 scale, which basically aims at characterizing the aquifer geometry, behavior of groundwater levels and status of groundwater development invarious aquifer system to facilitate planning of their sustainable management. The major activities involved in this process include compilation of existing data, identification of data gaps, generation of data for feeling data gaps and preparation of different aquifer layers. Once the maps are prepared, plans for sustainable management of groundwater resources in the aquifers mapped shall be formulated and implemented though participatory approach involving all stakeholders.



2.3. Data Availability

Exercise on Groundwater availability, groundwater monitoring (water level and chemical quality) and exploration had been carried out by CGWB and State Ground Water Department. 27 and 99 number of National Hydrological Stations are being monitored by CGWB, Jaipur and State Groundwater Department, Churu respectively. 84 No. of exploratory wells have been constructed by CGWB and 158 No. of exploratory wells have been constructed by CGWB (Table 1).

2.4. Data Adequacy

The data collected from State GWD and CGWB, WR, Jaipur have been compiled and analyzed. It has been observed that validation and geo-referencing of the location coordinates, lithologs and hydrogeological data is needed and State GWD data lacks in aquifer parameters. Geophysical data collected needs geo-referencing of the hydrogeological interpretations. It has been observed that available data are limited largely to State highways and main roads only. Hence, to get a clear 3D hydrogeological geometry of the aquifer system and its behavior, there is need to generate data by Groundwater Exploration and to establish more numbers of monitoring stations for better understanding of the groundwater regime behavior in terms of both quantity and quality.

Table 1: Existing Exploratory Data of Churu District

Block	CGWB	GWD
Bidasar	-	-
Churu	09	43
Rajgarh	21	29
Ratangarh	18	21
Sardarshahar	28	44
Sujangarh	05	17
Taranagar	03	04
District	**84**	**158**

Table 2: Depth wise Availability of EWs and PZs in Churu District

Block	No. of EW and PZ in the given Depth Drilled (m)				
	< 50 m	50 m - 100 m	100 m - 150 m	150 m - 200 m	> 200 m
Bidasar	-	-	-	-	-
Churu	04	20	30	02	.
Rajgarh	02	08	35	01	.
Ratangarh	02	22	11	01	02
Sardarshahar	-	30	14	13	14
Sujangarh	02	07	04	05	02
Taranagar	-	03	07	02	02
District	**10**	**90**	**101**	**24**	**20**

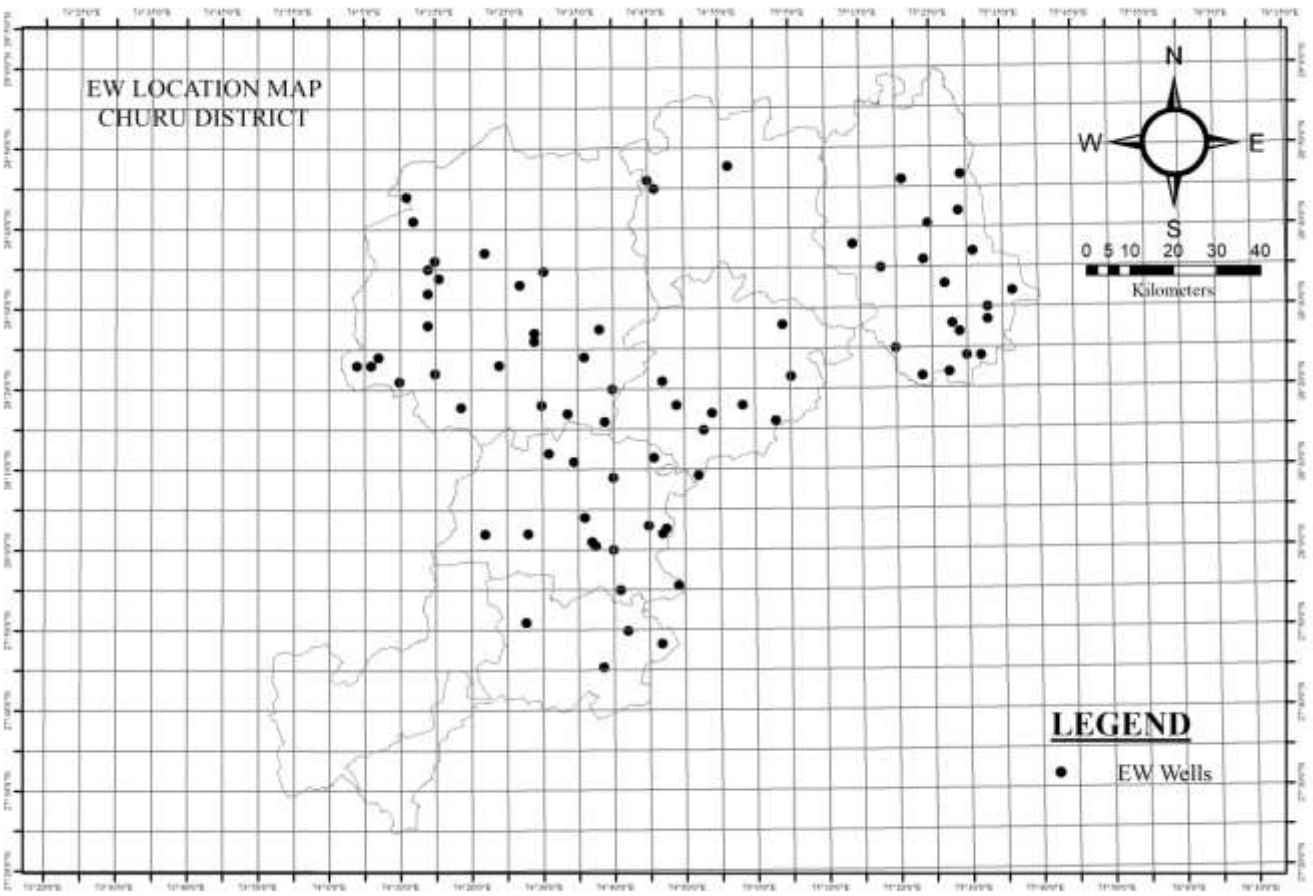


Figure 1 : Location of Exploratory Wells, Churu District.

2.5. Data Gap Analysis

Based on the data collected from State GW agencies like GWD, PHED, Water Resources and CGWB regarding groundwater monitoring, exploration, surface water and agriculture, the gaps were identified after plotting on 1:50000 map. Based on this map the gaps were identified for data to be generated like Bed Rock configuration, Saline/ Fresh water interface, Aquifer Continuity and Quality of groundwater in an area. Churu District further needs data to be generated in the gaps (Table 3).

Table 3: Data Availability and Data Gap Analysis in Churu District

S. No.	Study Aspect	Data Requirement	Data Availability	Data Gap
1.	**Rainfall and Other Climatic Data**	7 Meteorological Stations in the area.	Data Partially Available.	Other Climatic data other than rainfall.
2.	**Ground Water Monitoring Regime**	Representative Monitoring Wells distributed all over the Study Area.	CGWB NHS Wells - 27 GWD NHS Wells – 99 NAQUIM Key Wells - 103	-
3.	**Soil**	Soil Map and Soil Infiltration Rate.	Not Available.	Latest GIS based SoilMap and Soil Infiltration rate across the area.
4.	**Land Use**	Latest land use Pattern in GIS Platform.	Not Available.	Latest data in GIS platform required.
5.	**Geomorphology**	Digitized Geomorphological Map.	Available.	--
6.	**Geophysics**	Geophysical Survey in all Toposheets.	Nil	--
7.	**Exploration**	Exploratory Wells along with Aquifer Parameters.	Exploratory Wells along with Aquifer Parameters are scatterly available.	Exploration of deeper aquifers is required in all the blocks of the district.
8.	**Recharge Parameters**	Recharge parameters of different soil and aquifer types based on	Recharge parameters are given in Ground Water resource estimation.	--

		Field studies.		
9.	**Discharge Parameters**	Discharge parameters for different GW abstraction structures.	Discharge parameters are given in Ground Water Resource Estimation.	--

2.6. Study Area

Churu district is a district of the Indian state of Rajasthan in northern India and located in the North-eastern part of Rajasthan state. Churu district covers total area of 13793 sq.km and lies between 29° 00'0" & 26° 59' 20" north latitudes and 73° 52' 40" & 75° 40' 30" east longitudes fall under Survey of India's toposheet no. 45 E, 45 I, 44 L and 44 P. Churu district comprises about 4.03% of the total area of rajasthan state. The northern border of the district is surrounded by Hanumangarh district while southern border is surrounded by Nagaur, Sikar and Jhunjhunun districts. The upper eastern boundary is surrounded by Hisar district of Haryana state while the lower eastern boundary is surrounded by Jhunjhunun district. The western boundary of the district is exclusively neighboured by Bikaner district.

2.7. Administrative Set Up

Administratively, the district is divided into 7 sub-divisions and 8 tehsils viz. Churu, Bidasar, Rajgarh, Ratangarh, Sardarshahar, Sidmukh, Sujangarh and Taranagar. It has seven development blocks viz. Churu, Bidasar, Rajgarh, Ratangarh, Sardarshahar, Sujangarh and Taranagar. District has 917 villages (including 862 inhabited and 55 uninhabited), 10 urban towns viz. Bidasar, Chhapar, Churu, Rajgarh, Rajaldesar, Ratangarh, Ratannagar, Sardarshahar, Sujangarh and Taranagar. (District Census Hand Book 2019, Churu). As per census 2011, population of the district is 2,039,547 including 1,051,446(51.55%) male and 988,101 (48.45%) female with population density as 147persons/sq.km. The population in the rural area is 1463312 (71.75%) and 576235 (28.25%) in urban and sex ratio is 940 females per 1000 male. Administrative map of the district showing block boundaries, block headquarters, physical features is presented as figure-2.

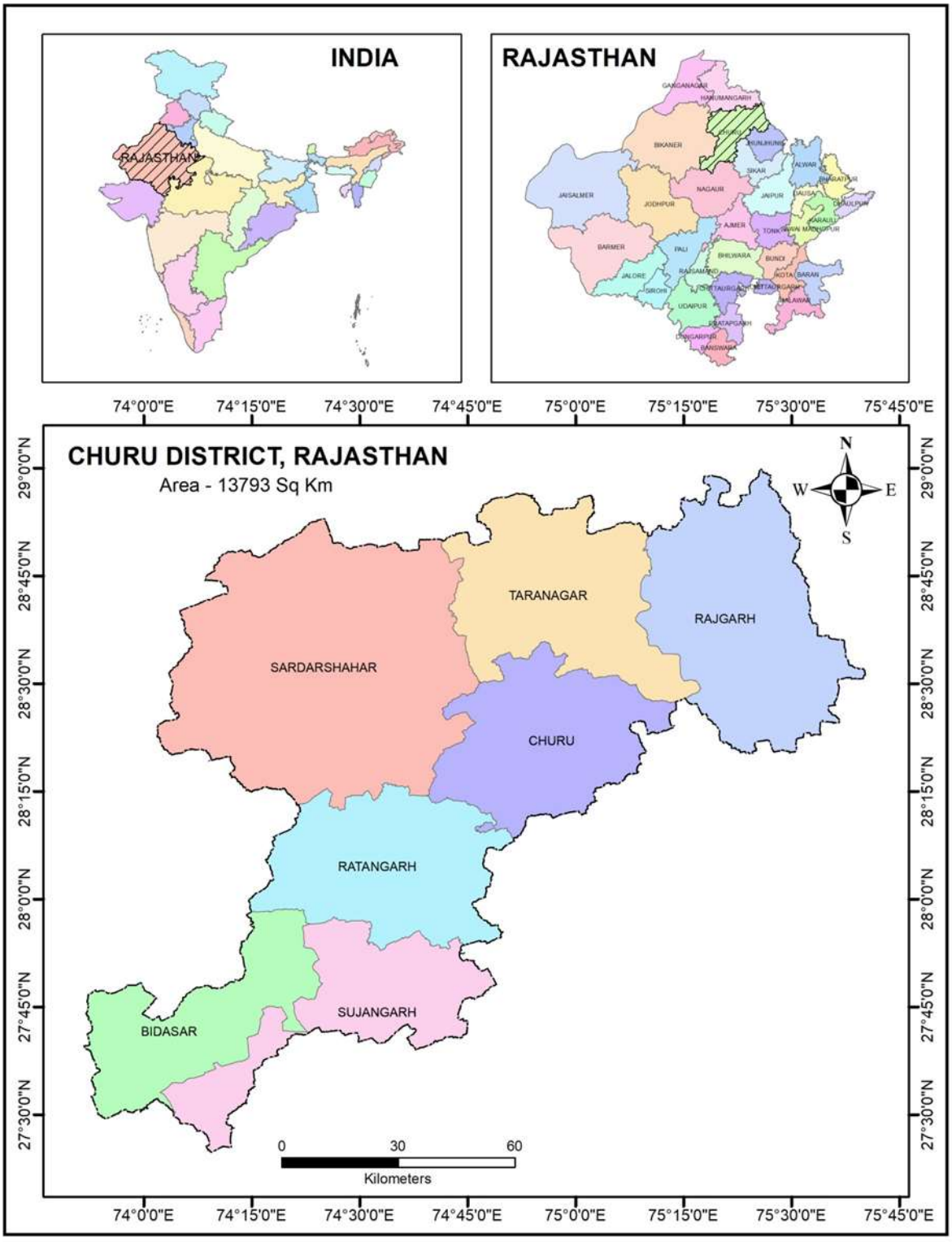


Figure 2. Administrative map of Churu District.

3. Geography

Churu district is located very near to northern extension of Aravalli hills which is trending NE-SW direction and rising to a maximum height of about 500 m above mean sea level in the area adjoining to district boundary. However, the major part of the district is covered with extensive blanket of sand; through which low lying isolated hillrocks of hard rock occur. The sand dunes which are mostly of settled nature and interdunal hallows form undulating topography. The regional trend of these sand dunes is along NE-SW or NNE-SSW direction. The district has gentle slope towards north or north-west, with the highest and lowest altitude being over 500 m and less than 230 m respectively above the mean sea level. The district is lacking any dominant hills except some scattered hillocks of considerable height and restricted lateral extension which have been observed at Gopalpura, Doongras, Balera, Randhisar in Sujangarh block and Biramsar in Ratangarh block. However, one or two small hillocks of granite are also exposed towards extreme north of Rajgarh block at Galar village.

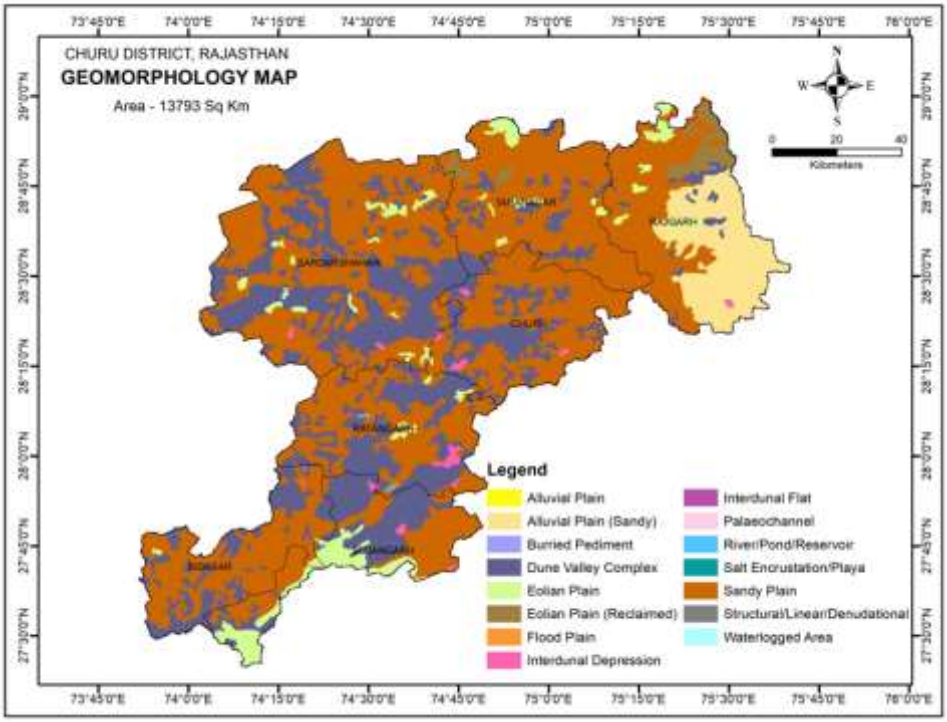
3.1. Geomorphology

The Churu district, exhibits various geomorphological landforms occurring in the district viz. Eolian plain, Interdunal depressions, Sandy Plain and Dune valley Complex. However, the major part of the district is covered with extensive blanket of sand, through which low-lying isolated hillocks of hard rock occur. The sand dunes which are mostly of settled nature and interdunal hallows form undulating topography. The geomorphology map of Churu district is presented in Figure - 3 and its details are tabulated in Table - 4.

Table 4 : Geomorphologic units, their description and distribution, Churu District

Origin	Landform Unit	Description
Aeolian	Dune Valley Complex	Cluster of dunes and interdunal spaces with undulating topography formed due to wind-blown activity, comprising of unconsolidated sand and silt.
	Eolian Plain	Formed by aeolian activity, with sand dunes of varying height, size and slope. Long stretches of sand sheet. Gently sloping flat to undulating plain, comprised of fine to medium grained sand and silt. Also scattered xerophytic vegetation.
	Eolian Plain (Reclaimed)	Gently sloping with sheet of sand or sand dunes, scattered xerophytic vegetation.
	Interdunal Depression	Slightly depressed area in between the dunal complex showing moisture and fine sediments.
	Sandy Plain	Formed of aeolian activity, wind-blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand, silt and clay.
Denudational	Buried Pediment	Pediment covers essentially with relatively thicker alluvial, colluvial or weathered materials.
Fluvial	Alluvial Plain (Sandy)	Flat to gentle undulating plain formed due to fluvial activity, mainly consists of gravels, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand along river.

Figure 3 : Geomorphology Map of Churu District.



3.2. Drainage

There is no major river system in the district, except for a few short, intermittent and ephemeral channels. The largest drainage course is the Kantli River which enters the district in the south- eastern side from Jhunjhunu district and disappears near Rajgarh, discharging storm runoff only in the period of high rainfall.

4. Climate

Churu district is a typical representative of semi-arid to arid climatic conditions except during the monsoon period. The temperature variation in the district is extreme throughout the year. In peak summers it rises upto 49.7°C (2018) or even more sometimes while in extreme winters it goes down below the freezing point upto 0.6°C (2018). Very hot and very cold winds are the dominant features of the district in summers and winters respectively. The district usually witnesses low and erratic rainfall with a very few exceptional years of heavy rainfall. Almost 95% of the total annual rainfall is received during the southwest monsoon, which enters the district in the last week of June and withdraws in the middle of September.

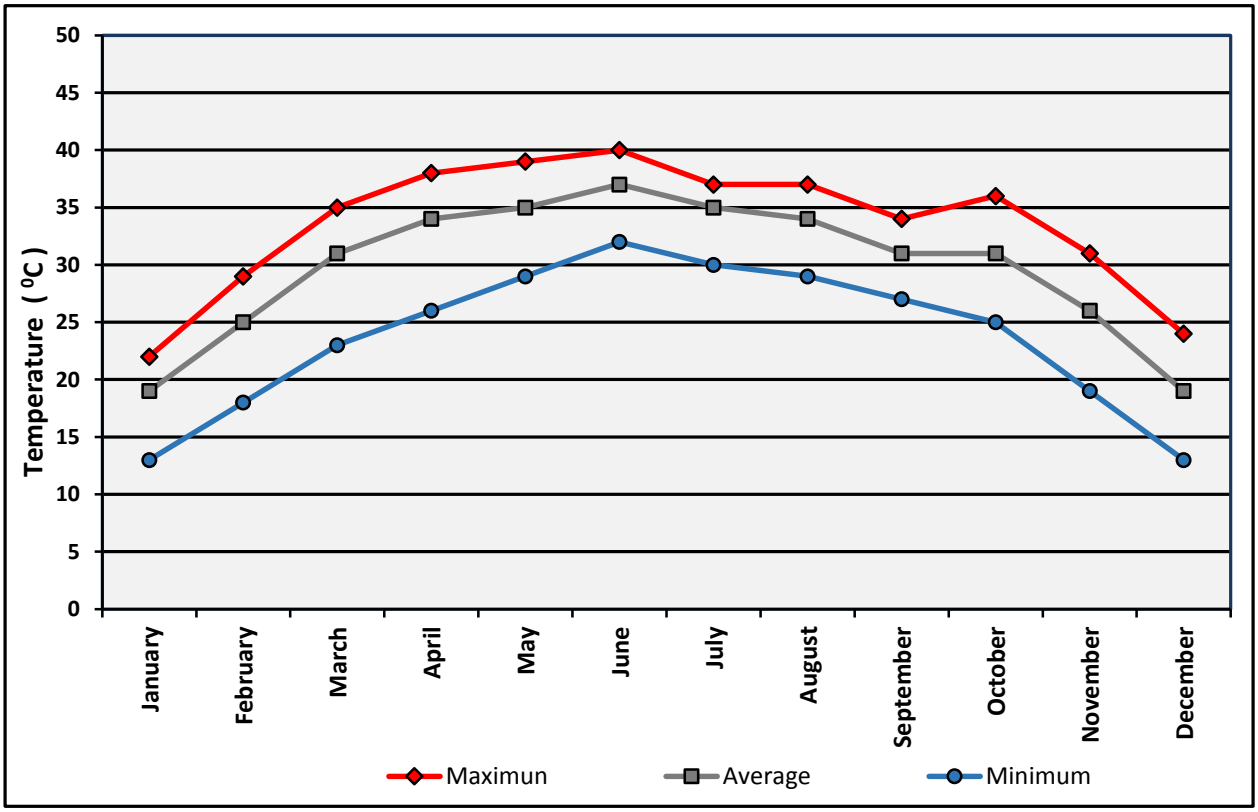


Figure 4: Monthly Temperature Variation of Churu District (Year-2021)

4.1. Variability of Rainfall

Statistical Analysis of rainfall data shows that rainfall in the district is quite erratic. The mean annual rainfall of the area during the study period was 406.4 mm with 118.4 mm standard deviation of 29.1% CV. High overall coefficient of variation indicate significant intra and inter- annual fluctuations in the rainfall. The minimum and maximum ever recorded rainfalls were 162.2 mm (in 2002 - the driest year) and 660.3 mm (in 2011 - the wettest year) per year respectively. Between the driest and wettest months, the difference in precipitation is 498.1 mm |19.61 inch (Table 6).

Table 5 : Statistical Analysis of Rainfall Data for the period 1991-2020

Block	Maximum RF (mm)	Minimum RF (mm)	Maximum RF (Year)	Minimum RF (Year)	Mean (mm)	SD (mm)	CV (%)
Bidasar	705.0	528.0	2020	2019			
Churu	650.0	165.0	1998	2009	439.0	139.5	31.8
Rajgarh	746.0	121.0	2009	1999	430.9	144.1	33.4
Ratangarh	713.0	78.0	2010	2002	361.4	148.5	41.1
Sardarshahar	657.0	110.0	2015	2020	356.9	136.7	38.3
Sujangarh	724.0	130.0	1995	2002	428.0	138.9	32.5
Taranagar	1001.0	249.0	2011	2002	422.3	176.5	41.8
District	**660.3**	**162.2**	**2011**	**2002**	**406.4**	**118.4**	**29.0**

The drought is a period of abnormal dry weather causing serious hydrological imbalance in the affected area. The study of drought trends is very much useful for these droughts affected regions where the annual rainfall is highly variable with frequent dry spells. The yearly intensity of drought has been determined using the criteria suggested by IMD which is based on the percentage deviation of rainfall from its long term mean and it is given by:

$$D_i = \frac{(\textbf{Annual Rainfall} - \textbf{Mean Annual Rainfall})}{\textbf{Mean Annual Rainfall}} \textbf{ x 100 ;}$$ where D_i = Percent Departure

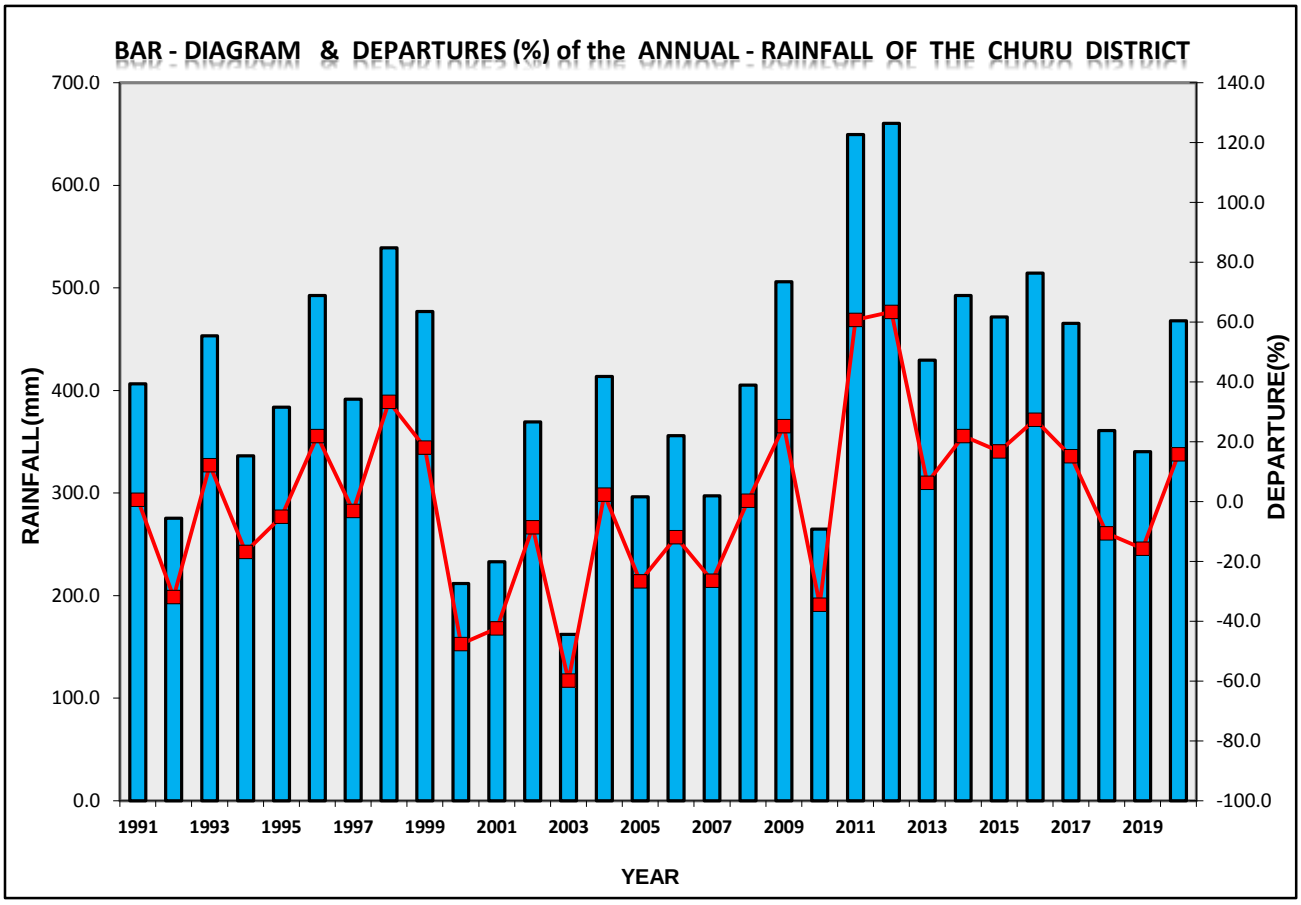
Annual drought intensities show that most of the years in the last 20th century had observed mild to moderate drought with few years of normal rainfall (1991-2000), whereas in the 21st century a majority

of the years have received more than normal rainfall with only few years experiencing mild to moderate drought (2001-2020). The frequency of occurrence of drought in the district is 46.66 % (Table 7)

Table 6 : Drought classification based on % Departure of Rainfall from Long Term Normal value (IMD, 1991)

Percentage Departure of Rainfall from Normal	Intensity of Drought	No of Years (1991-2020)	Percent (%)
> 0	No Drought	16	53.33
0 to -25	Mild Drought	07	23.33
-25 to -50	Moderate Drought	06	20.00
-50 to -75	Severe Drought	01	3.33
< -75	Extreme Drought	-	-

Figure 5 : Temporal Variation of Annual Rainfall (1971-2021) in Churu District.



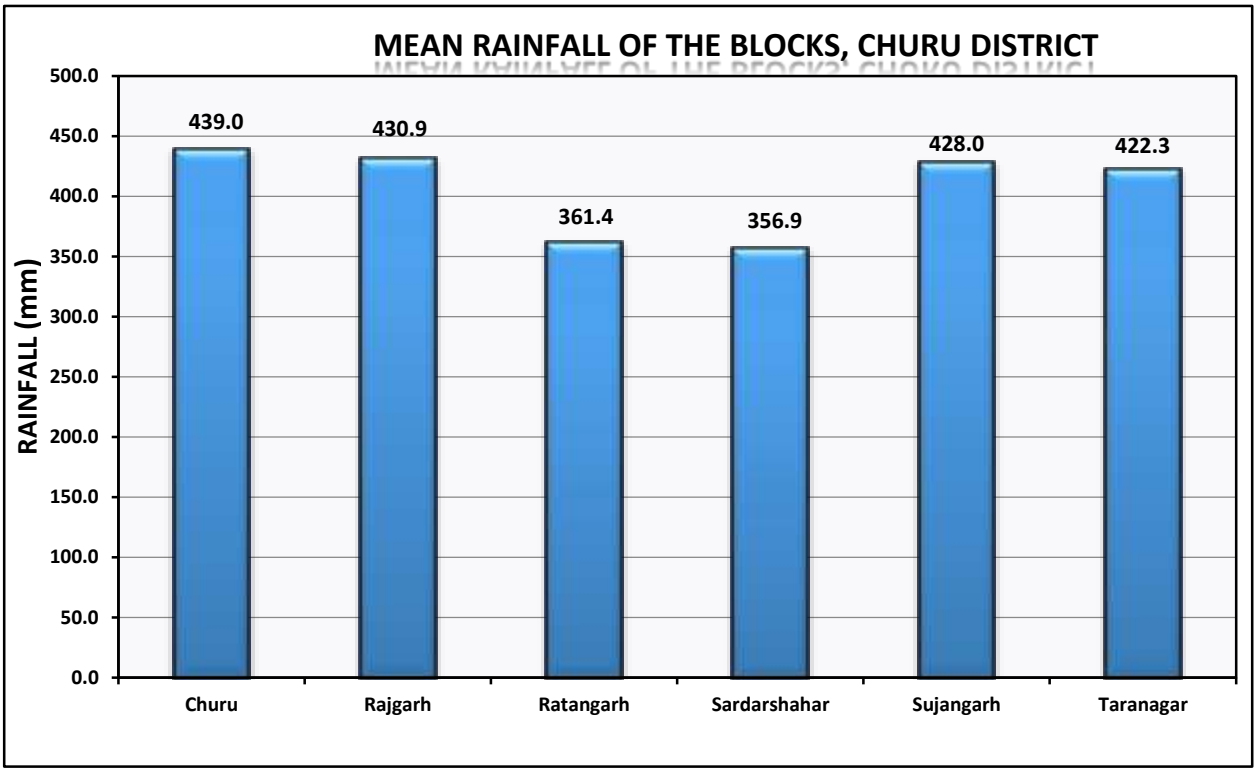


Figure 6 : Average Annual Rainfall in Blocks of Churu District.

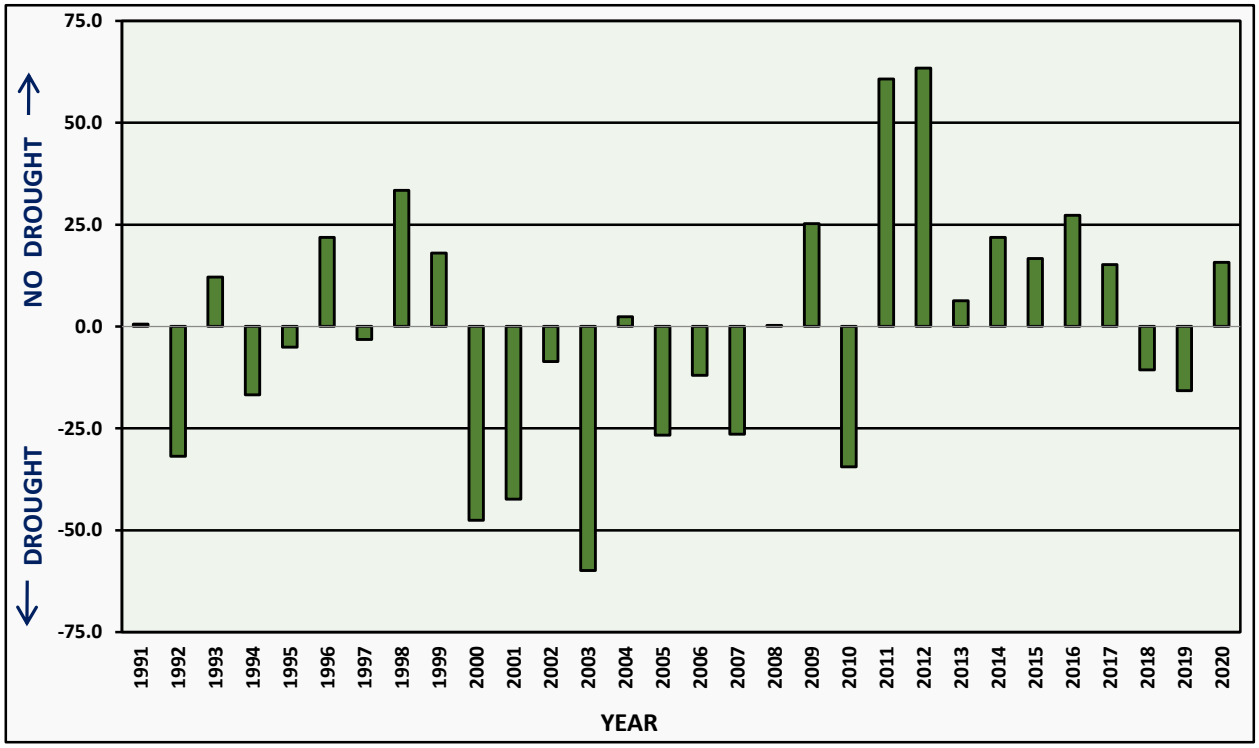


Figure 7 : Plot of the temporal drought intensity in Churu district.

5. Land Use

The total geographical area of the district is 1385905 hectares. The net Forest Area including hills in the Churu district is 6523 hectares and net sown area is 1030284 hectares. The other uncultivable land excluding current fallow is 58564 hectares and the total fallow land is 122730 hectares as per District Statistical Outline (Figure 9).

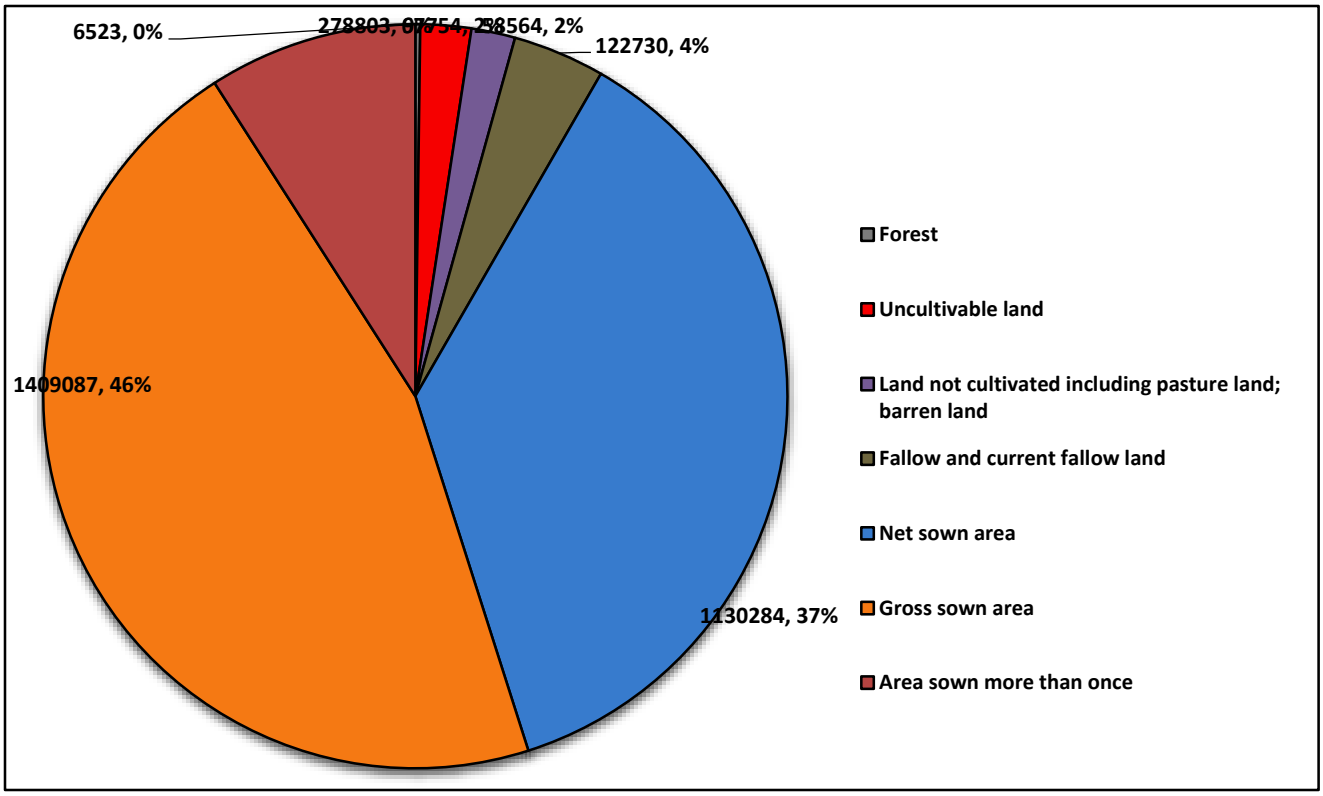


Figure 8 : Land use pattern of Churu District

5.1. Forest

The forest are scattered over a large area, mostly in hills and ridges. Those in plains are grass birds or tree savants. The district comprises of 13793 sq. kms of geographical area, out of which 73.73 sq. kms is covered with forest, which is around 0.52% of total district. This includes 7.19 sq. kms reserved forest, 48.57 sq. kms protected forest and 17.95 sq. kms under unclassified forest. Primarily this area has vegetation that is mainly found in desert areas like trees of Acacia, Ber/ Ziziphyus, Tortalis, Khejri and Kumtha etc. and Shrubs of Thor, Phog etc.

Tal Chhapar Sanctuary

Tal Chhapar was declared a 'Reserved Area' for the protection of wild animals and birds. Tal Chhapar is located on the fringe of the Great Indian Thar Desert is nestled a unique refuge of the most elegant Antelope encountered in India "The Black Buck". Tal Chhapar sanctuary with almost flat tract and interspersed shallow low-lying areas has open grassland with scattered Acacia and Prosopis trees which give it an appearance of a typical Savanna. Tal chhapar wildlife sanctuary is a unique protected area which bears fair population of Blackbuck in a small area of 719 Ha. In real sense it is a Blackbuck sanctuary. Wild animals found in the sanctuary are Blackbuck, fox, Chinkara, Jungle cat wolf etc.

5.2. Soil

Soil is the loose surface material that covers most land. It consists of organic matter and inorganic particles including minerals, gases, liquids, and organisms that together support life. Soil provides the structural support to plants used in agriculture and is also their source of water and nutrients. Earth's body of soil, called the pedosphere, has four important functions :

- as a medium for plant growth
- as a means of water storage, supply and purification
- as a modifier of Earth's atmosphere
- as a habitat for organisms

All of these functions, in their turn, modify the soil and its properties. Soils vary greatly in their chemical and physical properties and on the basis of theses the soil in the district has been classified into –

- **Desert Soil -** The southern part the district is occupied by desert soils. The desert soils are usually light yellowish-brown to yellowish brown colour.
- **Red Desert Soil -** The red desert soils occupy a narrow belt in the southern and western parts of the district i.e., south of Sardarshahar and around Ratangarh. They are typically deep brown, non-calcareous, loamy sands and sandy loams, partially derived from sandstone and alluvial deposits.
- **Saline Soil -** The saline soils are found in low interdunal areas and areas of fine texture. Generally, they are saline or sodic having low permeability value and impeded drainage.

5.3. Agriculture

Agro-ecologically the district has been part of Semi-Arid alluvium plain & hill zone. The soils of the district are yellowish-brown, deep brown, non - calcareous, loamy sands, sandy loam and less annual rainfall in the district, agricultural activity is much less and is highly dependable and one of the primary occupation of the locals. Churu district has suitable agro-climatic conditions for various food grain, pulse, oilseed and horticultural crops. There is also very good scope for development of dairy farming because of the availability of land resources as Pasture land. Agriculture activity in the district is carried out in both the Kharif and Rabi seasons thus reflecting the dependency on the groundwater resources. The season-wise major crops grown in the area are given in Tables 7 and 8.

Table 7 : Season wise major crops sown in Churu district

Season	Major Crops Grown
Kharif	Jowar, Bajra, Maize, Cotton, Til, Pulses and Ground Nut
Rabi	Wheat, Barley, Gram, Mustard, Taramira
Zaid	Jowar, Bajra, Gram, Urad, Moong, Moth, Chaula, Fruits and Vegetables

Table 8 : Major crops of Churu District

Food Grain	Bajra, Wheat, Jowar, Barley, Maize,
Pulses	Gram, kharif Pulses, Moong
Oil seeds	Rai & Mustard, Til, Ground Nut, Arandi/Taramira
Non-food grains	Cotton, Fenugreek, Isabagol, Gwar patha, Cumin, Gwar

5.4. Irrigation

The principal means of irrigation in the district are through wells and canals. But through canals only areas 7% area is irrigated (227.91 sq.km.). Ground water plays an important role for irrigation contribute almost 93% and is utilized through dug wells, dug cum bore wells, tube wells and bore wells run almost by electricity in the area. Out of gross sown area of 14090.87 sq. km, only 2939.10.90 sq.km. area is irrigated. There is total 7836 utilizable wells, 248360 Electricity operated tube wells and 22759 pumping sets. Net and gross sown area as per source is given in table 9 and block-wise irrigated

area through various sources in table 10.

Table 9: Details of Area irrigated with sources in Churu District.

	Dugwells	Tubewells	Ponds	Canals	Other	Total
Net Sown Area	13130	145463	0	17677	0	176270
Gross Sown Area	22759	248360	0	22791	0	293910

Source: District Outline, Churu, 2019

Table 10: Block-wise Irrigated Area in Churu District

Block	Dugwells		Tubewells		Ponds		Canals		Others		Total	
	Net irrigated	Gross irrigated	Net irrigated	Gross irrigated	Net irrigated	Gross irrigated	Net irrigated	Gross irrigated	Net irrigated	Gross irrigated	Net irrigated	Gross irrigated
Churu	764	764	4818	5107	0	0	0	0	0	0	5582	5817
Bidasar	0		39071	61554	0	0	0	0	0	0	39071	61554
Rajgarh	12366	21995	108	108	0	0	0	0	0	0	12474	22103
Ratangarh	0	0	23300	39255	0	0	0	0	0	0	23300	39255
Sardarshahar	0	0	64737	117875	0	0	7405	9363	0	0	45966	117875
Sujangarh	0	0	13429	24399	0	0	0	0	0	0	13429	24399
Taranagar	0	0	0	492	0	0	10272	13428	0	0	10272	13920

6. Geology

The whole of central and northern part of the district is occupied with primarily eolian sand and partly by fluvial deposits. The southern part of the district has some exposures of hardrock covered by Marwar Super Group which includes the rock formation of sandstone, shales and limestone. The small area of southwestern part of the district, in Sujangarh block occupies Erinpura granite & gneiss. Recent to sub-recent sand deposits of quaternary era has entirely concealed the geological units of the district. A major fault running NNE - SSW has absolutely divided the district in two parts. Towards east of the fault the basement rock mostly granite/rhyolite/gneisses is very shallow and is encountered at a depth ranging between 80 to 135 mts below ground level. Towards west of the major fault the basement is comparatively very deep and its depth is yet to be explored. The extreme south-western part of the district has faced another complex system of faulting and consequently the Bilara formations are lying in juxtaposition to Jodhpur/Nagaur formations and Gneissic basement. It has also been observed that the area around Sardarshahar and Ratangarh towns has also witnessed a complex system of local faulting of restricted extension and as a result of it various types of basement are being encountered in these areas at a various depth range. The generalized geological succession of the district is given in table.

Table 11 : Detailed Geological Succession of Churu District

Super Group	Group	Formation
	Recent to Sub-recent	Wind-blown sand and older alluvium
X X X X Unconformity X X X X		
	Paleocene	Gravel Beds, Claystone, Shale and Sandstone
X X X X Unconformity X X X X		
Marwar	Nagaur, Bilara and Jodhpur	Nagaur Series (Sandstone, Shales, Evaporite sequence), Bilara formation (Limestone & Shales), Jodhpur formation (Sandstone & Shales)
	Post Delhi Intrusives	Rhyolites and Granites, Phyllites
Delhi		Schists and Quartzites.

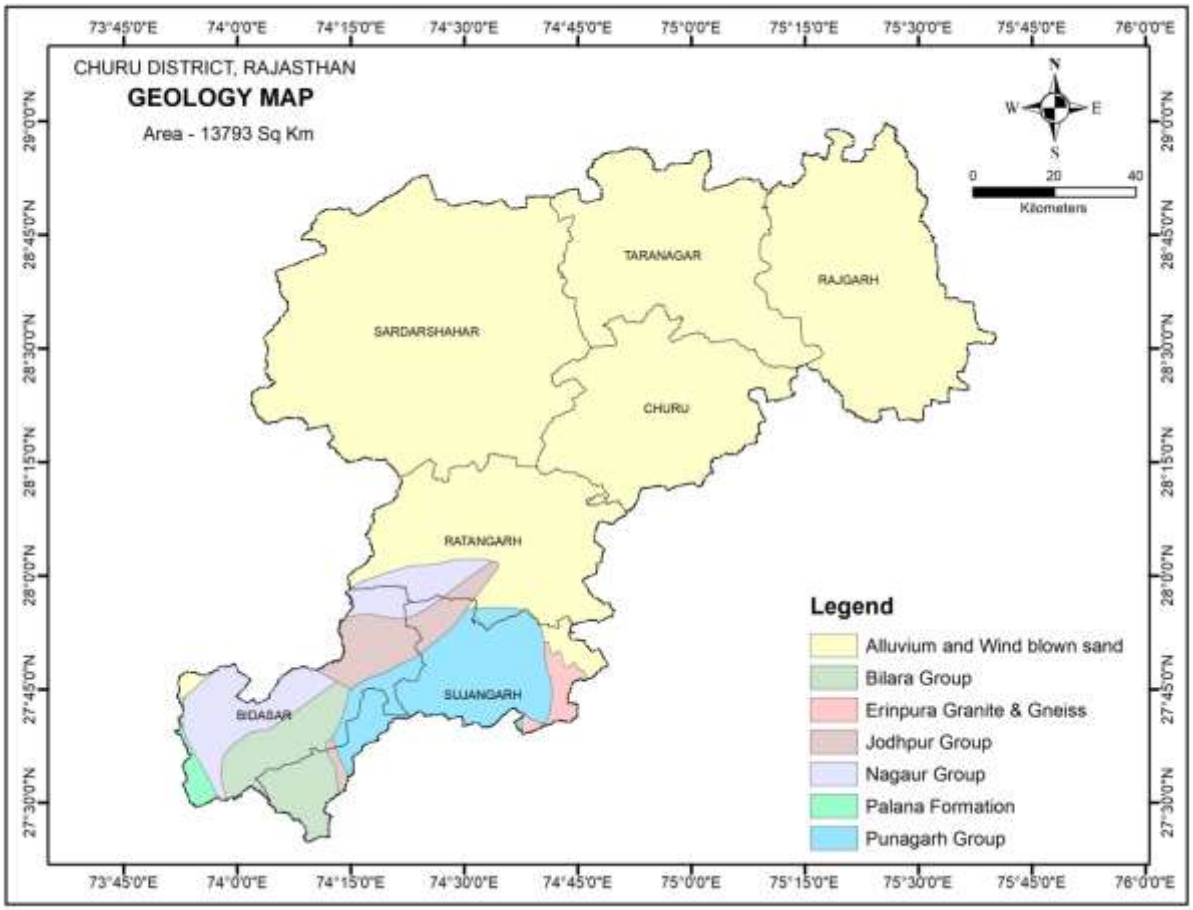


Figure 9 : Geological Map of Churu District

6.1. Hydrogeology

The occurrence of ground water is generally controlled by the topographic features and physical character of the water bearing formation. The ground water generally occurs under phreatic condition. The principal source of ground water recharge in the district is rainfall. The major part of the rain goes under surface run off and evapo-transpiration and only a small part of rain water infiltrates and recharge the ground water. Water bearing formations in Churu district range from unconsolidated alluvium to semi consolidated sandstones and consolidated schistose rocks. The older and younger alluvium constituted of primarily sand of windblown and fluvial origin forms aquifers covering most of the area of district. Other most prominent aquifers in the district are sandstones followed by schist and limestone aquifers. The hardrock aquifers are prominent in southern and partly in western part of the district. On the basis of exploration in various part of the district revealed that there are five main water bearing formations in the district. The main water bearing formations in the district are

younger alluvium, older alluvium, Tertiary & Nagaur sandstone, Bilara Limestone and Jodhpur Sandstone are designated into potential zones as "ALO1", "ALO3", "STO6b" “LSO3”and "STO6a" respectively. The same pattern has also been adopted in naming ground water saline zones and named as “ALO1” (S), “ALO3” (S), “STO6b” (S) and “STO6a”(S) for Younger alluvial, older alluvium, Tertiary & Nagaur sandstone and Jodhpur Sandstone respectively. Spatially, older alluvium is the major water bearing formation covering major portion (56.7%) of the district area, Younger alluvium occupy almost similar spatial areas (14.3%) of the district. Nagaur & Jodhpur Sandstone also form good aquifer with almost 17.5% of total district area. Bilara Limestone covers 4.7% district area and Schist aquifers occupy almost 6.8% area of district. In the hard rocks there are weathered and fractured zones (joints and fractures) through which the ground water moves. Groundwater circulation is mainly controlled by the extent, degree of weathering, number of fractures and their intensity per unit area and size, openness, interconnection and continuity of structural weak planes. Thickness of weathered and fractured zone varies considerably. The ground water generally occurs under water table condition ɒ semi-confined conditions. Sandstones also contain water in their primary openings that can yield water even if they are massive and compact (Table 12).

Table 12 : Major Aquifer Potential Zones, their Area and their description

Aquifer in Potential Zone	Area (sq km)	% age of district	Description of the unit/Occurrence
Younger Alluvium	1,976.7	14.3	It is largely constituted of Aeolian and Fluvial sand, silt, clay, gravel and pebbles in varying proportions.
Older Alluvium	7,854.0	56.7	This litho-unit comprises of mixture of heterogeneous fine to medium grained sand, silt and kankar.
Bilara Limestone	655.0	4.7	It is grey to buff coloured hard and compact.
Nagaur& Jodhpur Sandstone	2,415.1	17.5	Buff to reddish brown in colour, fine to medium grained hard and compact sandstone.
Schist	943.2	6.8	Medium to fine grained compact rock. The litho units are soft, friable and have closely spaced cleavage.
Total	**13,844.0**	**100.0**	

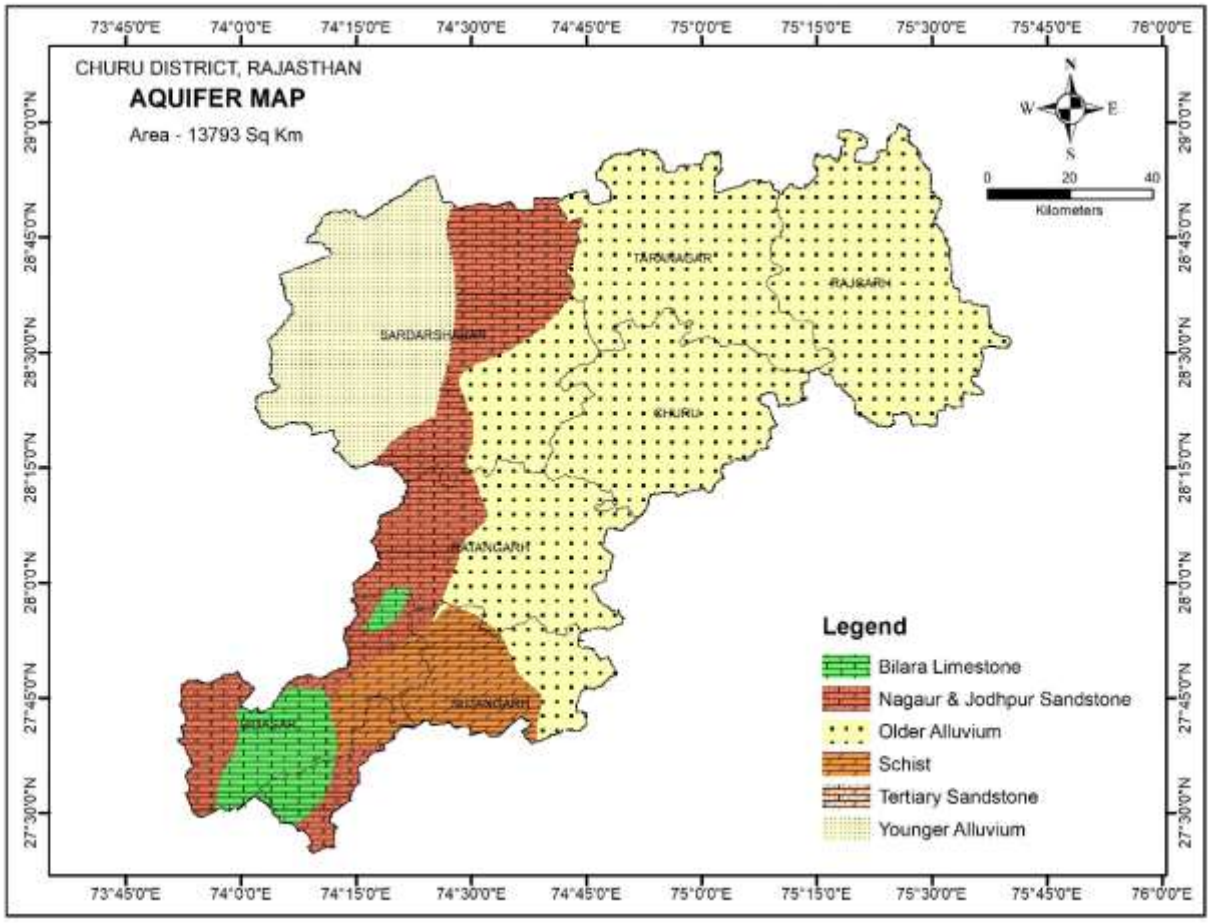


Figure 10 : Aquifer Map of Churu District

- **Younger Alluvium**

These formations have been observed towards the extreme north-western part of the district in a large number of villages of Sardarshahar block. They comprise stream-laid deposits, such as sand, sandy-clay, kankar, etc.

- **Older Alluvium**

These formations have been encountered towards east of the major fault mainly in Churu, Rajgarh, Ratangarh and Taranagar blocks of the district. However, these formations have also been observed in a small area of Sardarshahar and Sujangarh blocks towards their southeastern and north-eastern parts respectively. These formations comprise sand, sandy-clay, clay, kankar, etc.

- **Tertiary Formations**

These formations have been encountered in an extremely small pocket towards south west of Sardarshahar block. These comprise loose to semi-consolidated sandstones, clay, and gravel deposits.

- **Nagaur Formations**

These formations have been encountered mainly towards western parts of Ratangarh and Sujangarh blocks. However, an extremely small pocket of these formations has also been observed towards extremely southern-western part of Sardarshahar block. These formations comprise loosely consolidated, brick-red coloured, medium to coarse grained sandstones and shales.

- **Bilara Formations**

These formations observed mainly in Sujangarh block. However, a very small pocket of these formations has also been observed towards extreme south west of Ratangarh block. These formations comprise grey-coloured limestone and red coloured, medium grained sandstones & shales.

- **Jodhpur Formations**

These formations have been observed as a typical long strip of restricted lateral extension along the major fault in the central part of the district. However, a small pocket of such formations has also been observed towards south-western part of Sujangarh block. Light whitish brown, medium to coarse grained sandstones are the only component of these formations.

6.2. 3-D and 2-D Aquifer Disposition

The data generated during ground water exploration by constructing exploratory wells, observation wells, slim holes and piezometers (Annexure-A), was utilized to decipher the aquifer disposition in the area. Based on the existing data set 90 observation points were selected for the study of aquifer disposition in 3D and several hydrogeological sections along section lines using Rockworks software shown in Figs. 15-17, to understand the subsurface disposition of aquifer system. Lithological 3D representation of the study area clearly depicts that it mainly comprises of the Alluvium formations followed by the Sandstone and Limestone formations.

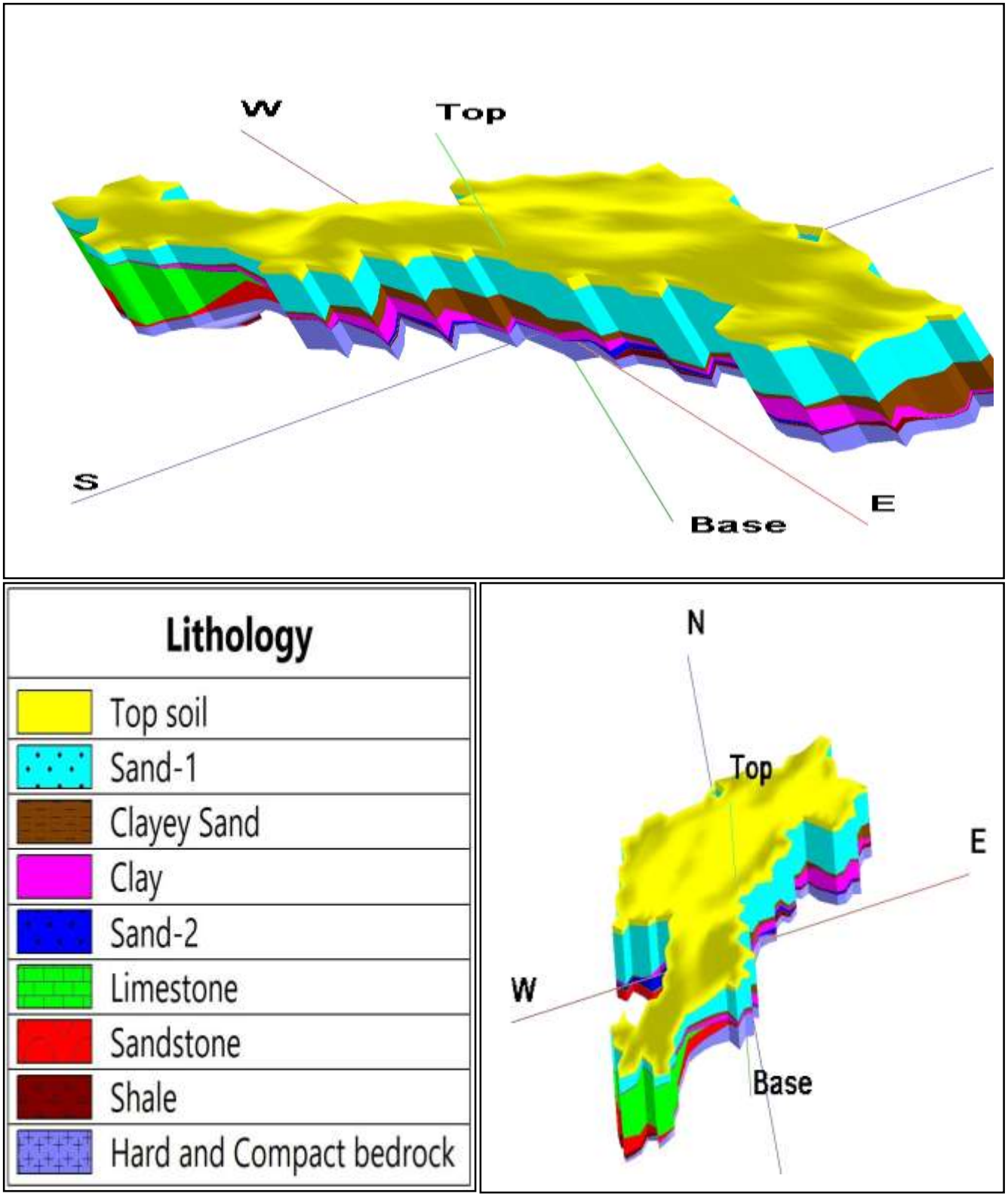


Figure 11: 3D Lithological Model of Churu District.

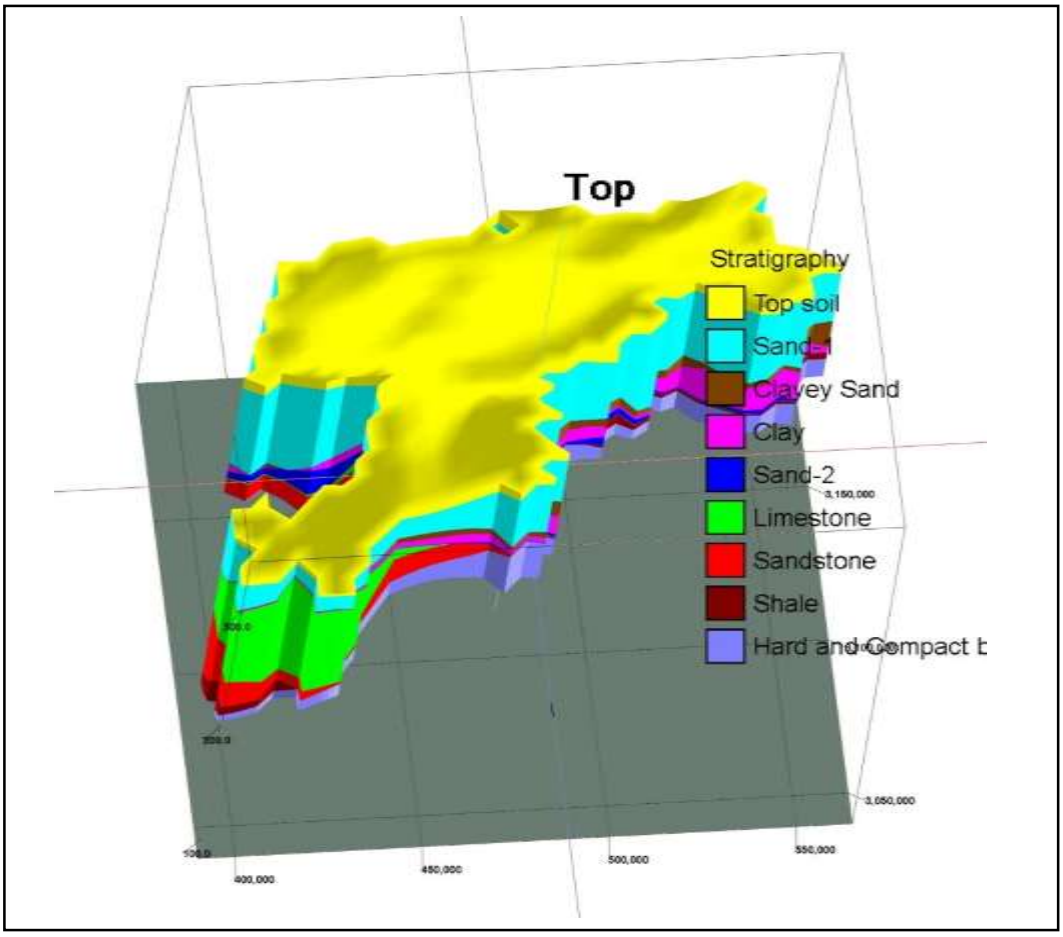
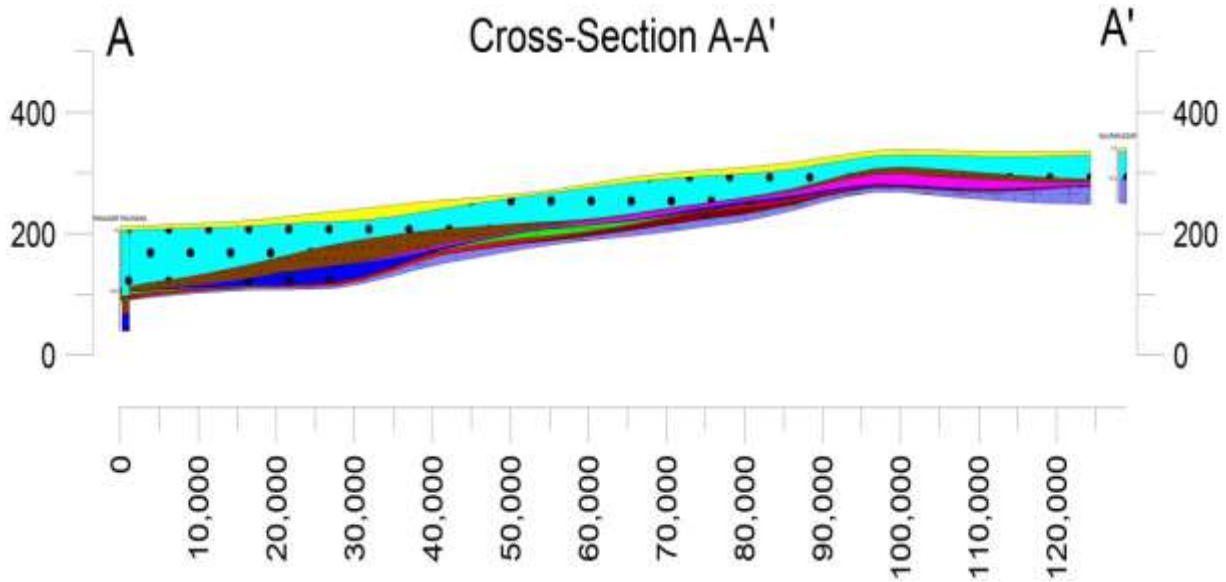


Figure 12: 3D Lithological Model of Churu District.



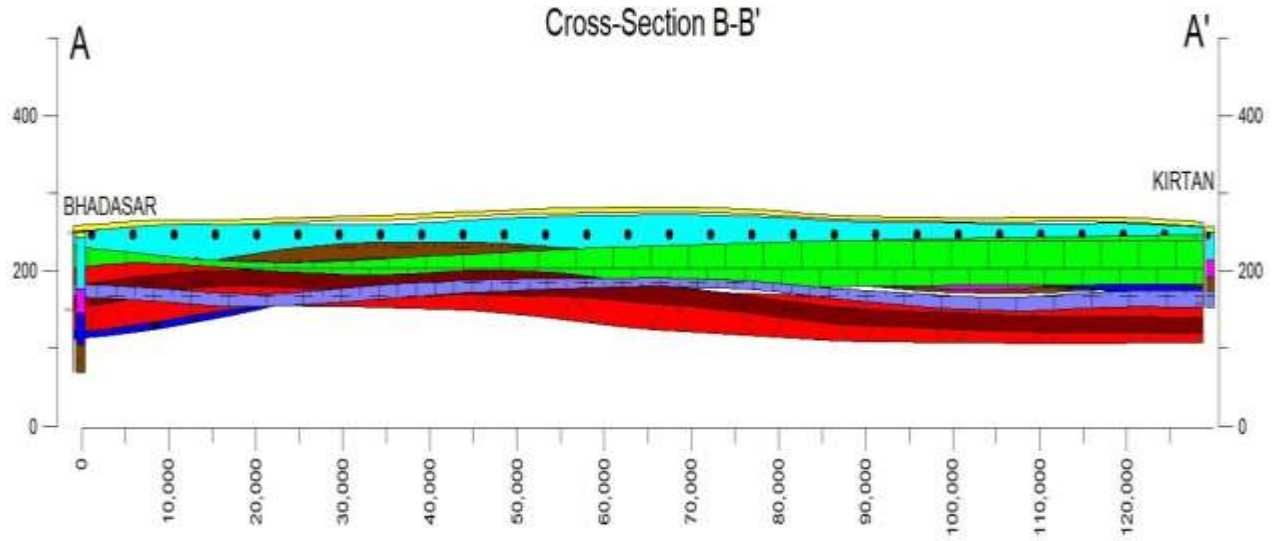


Figure 13: Aquifer Disposition 2D cross section (a) from Rajasar to Naurangsar (b) from Bhadasar to Kirtan.

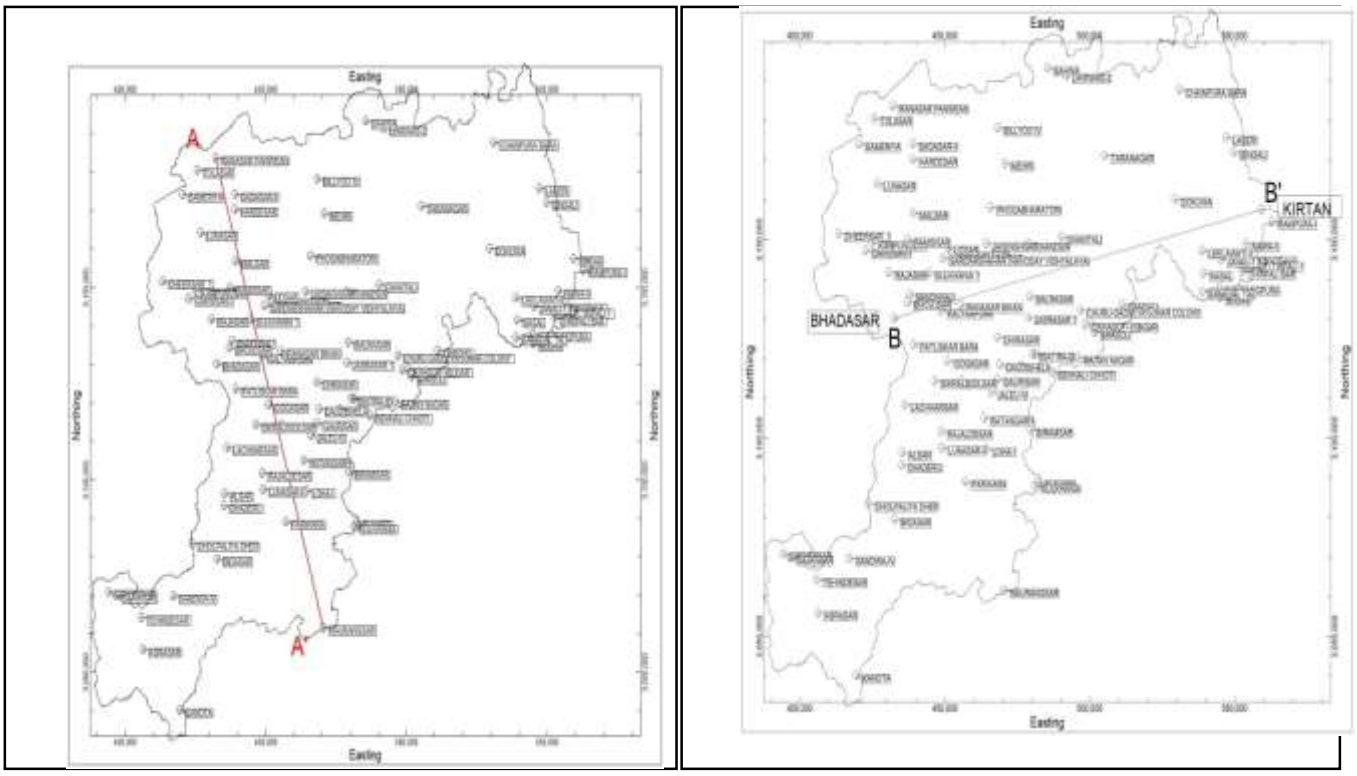


Figure 14 : Sections lines of both the 2D sections represented above

7. Ground Water Dynamics

Central Ground Water Board periodically monitors National Hydrograph Network Stations (NHS) stations in the Churu District, four times a year i.e. in January, May (Pre-monsoon), August and November (Post monsoon). The total number of hydrograph stations in the district is 39 comprising of 28 dug wells and 11 piezometers, in which total 25 is monitored in present time . State Ground Water Department monitors water levels in 102 wells two times in a year i.e. in May and November. The monitoring wells of state GWD comprisesof 78 dug wells, 25 piezometers in the district. During field work carried out for NAQUIM studies 103 key wells were established in the area where there was a gap in water level data of previous years (Annexure C). In total 230 wells were monitored during May (Pre Monsoon) 2021 and November (Post Monsoon) 2021 to generate the water level scenario in the district. The comparative block-wise detail of wells analyzed during both the seasons is tabulated in Table 13 and well-wise details are presented in Annexure C.

Table 13: Block-wise Depth to water Level Ranges in Pre Monsoon and Post Monsoon in Churu District

Block	Season	Depth To Water Level (m bgl)						Total
		<10	10-20	20-40	40-80	80-100	>100	
Bidasar	Pre Monsoon_2021	1	-	-	8	1	3	**13**
	Post Monsoon_2021	1	-	-	8	1	3	**13**
Churu	Pre Monsoon_2021	-	2	28	10	-	-	**40**
	Post Monsoon_2021	-	2	28	10	-	-	**40**
Rajgarh	Pre Monsoon_2021	-	8	22	9	2	-	**41**
	Post Monsoon_2021	-	8	22	9	2	-	**41**
Ratangarh	Pre Monsoon_2021	-	-	10	17	-	6	**33**

	Post Monsoon_2021	-	-	10	17	-	6	**33**
Sardarshahar	Pre Monsoon_2021	-	1	9	38	3	3	**54**
	Post Monsoon_2021	-	1	9	38	3	3	**54**
Sujangarh	Pre Monsoon_2021	3	3	15	6	-	3	**30**
	Post Monsoon_2021	3	2	15	6	-	3	**30**
Taranagar	Pre Monsoon_2021	1	8	8	2	-	-	**19**
	Post Monsoon_2021	1	8	8	2	-	-	**19**
District	Pre Monsoon_2021	**5**	**22**	**92**	**90**	**6**	**15**	**230**
	Post Monsoon_2021	**5**	**21**	**92**	**90**	**6**	**15**	**230**

7.1. Depth to Water Level – Pre-monsoon (May-2021)

The depth to water levels in Churu district during May 2021 ranges between 8.04 (Bidasar, Bidasar block) and 127.2 mbgl (Dhani Kumharan, Bidasar block). While reported water levels of tubewells ranges between 8.3 (Bobasar, Sujangarh block) and 192.02 mbgl (Lachharsar Sardarshahar, Bidasar block). Deeper water level i.e. more than 40 m bgl has been recorded in 111 observation wells, while Depth to water level between 10 to 20 m bgl has been observed in 22 observation wells along the North- eastern portion of the district. Water level between >10 m bgl has been recorded in 05 wells scattered in South-western and North eastern part of the district. 15 monitored wells have depth of water level more than 100 m below ground level and the aerial distribution of them lies in the hard rock area of the district such as Bidasar, Ratangarh, Sujangarh Blocks. The pre-monsoon depth to water level map is depicted in Fig. 19.

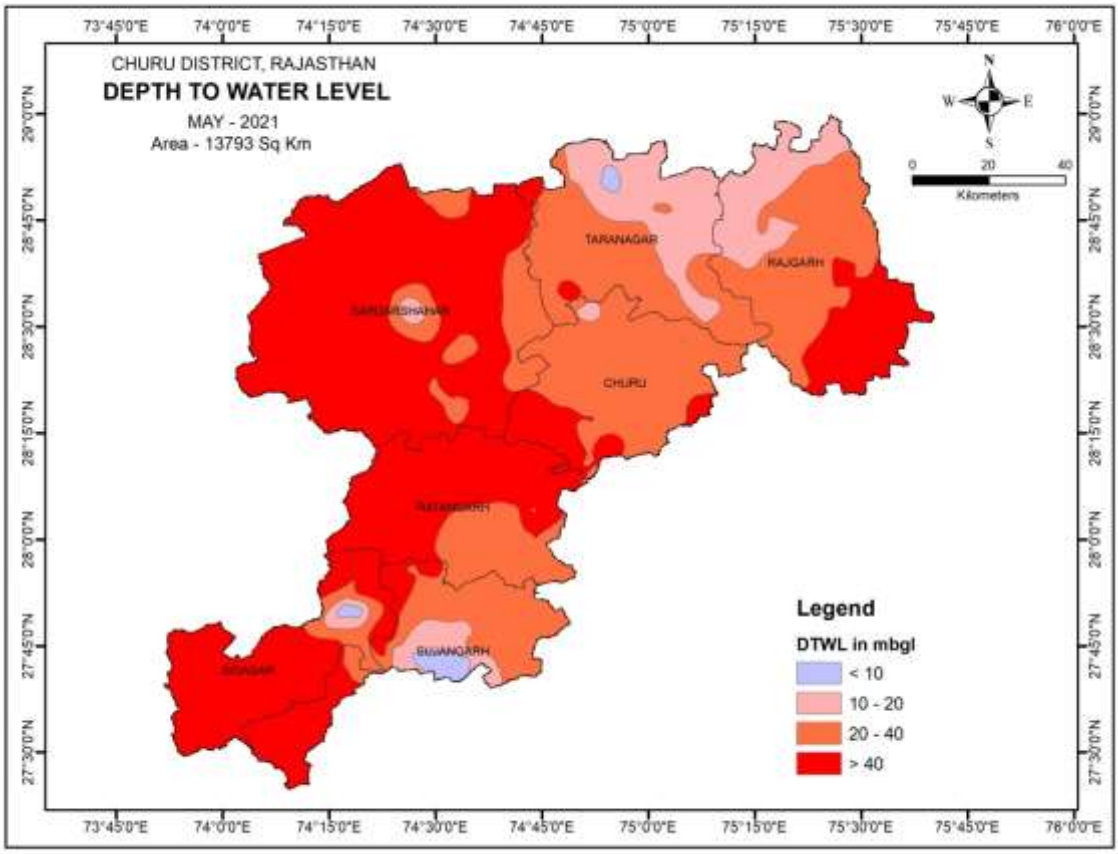


Figure 15 : Depth to water level map of May 2021 of Churu District.

7.2. Depth to Water Level – Post-monsoon (Nov-2021)

The depth to water levels in Churu district during Nov. 2021 ranges from 7.81 mbgl (Bidasar, Bidasar block) and 127.1 mbgl (Dhani Kumharan, Bidasar block). Shallow water level >10 mbgl is observed in 5 observation wells scattered in Bidasar, Sujangarh, Rajgarh blocks of the district. A deeper water level more than 40 mbgl is being observed in 111 wells. Deeper water levels are mostly confined to the western portion of the district as compared to the eastern side. The locations having depth to water level > 20 mbgl in pre monsoon and post monsoon almost remains unchanged in both the seasons in all the blocks. Spatial variation in post monsoon depth to water levels is shown in Figure 20.

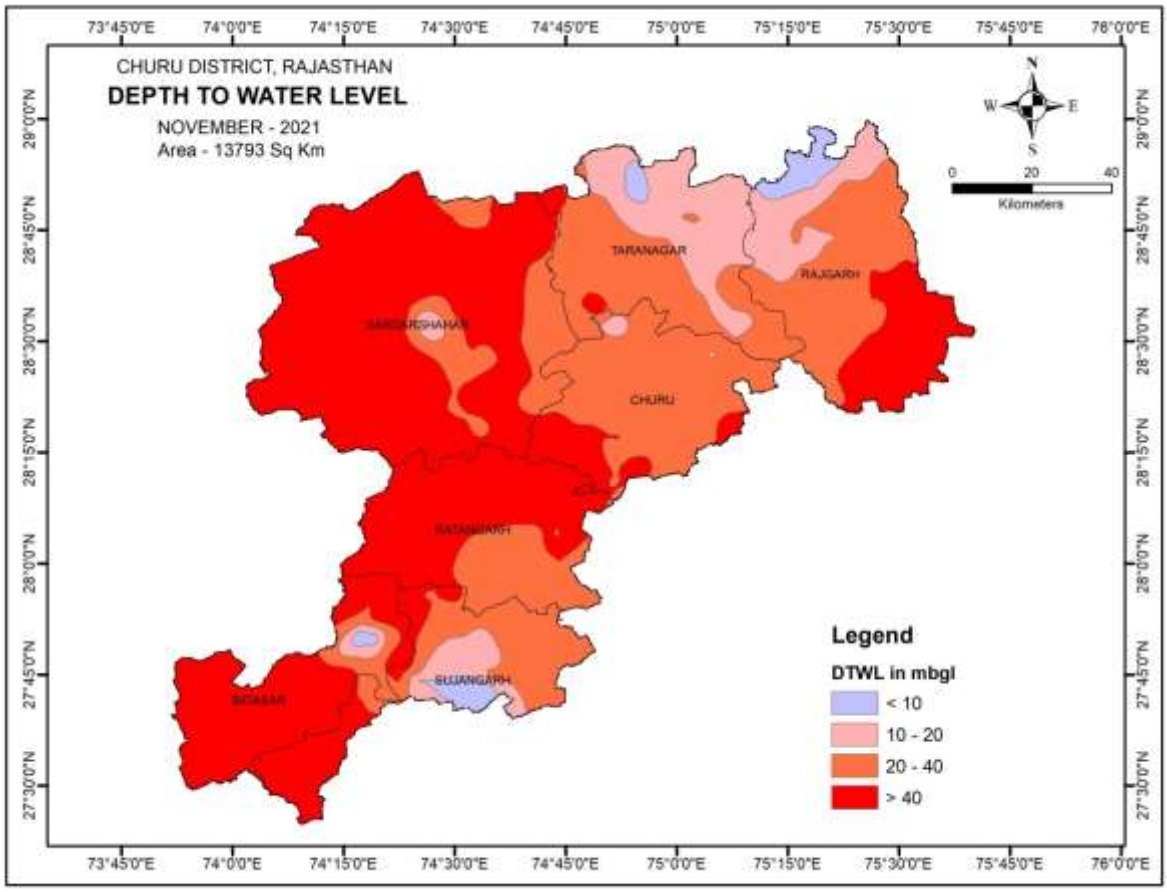


Figure 16 : Depth to water level map of November 2021 in Churu District.

7.3. Water Level Fluctuation (Pre – Post Monsoon, 2021)

Analysis of water level data of Pre and Post-monsoon 2021 indicates that there has been rise and fall in water level in almost the entire district (Figure 21). A perusal of water level fluctuation data indicates that rise in water level of 0 – 2 m has been recorded in the major portion of the district and the rise of more than 4 m has been observed in the small portion of the district. Decline in the pre and post monsoon water level has been observed in most of the part of the district, mainly concentrated in the north-eastern and south-western part of the district. Such a rising trend in the fluctuation map of Pre and Post monsoon seasons can be attributed to the nature of the water bearing formations in the area, with all the major aquifers being alluvial formations, thir is very small effect of rainfall had been reflected in the depth to water level with the post monsoon water levels .

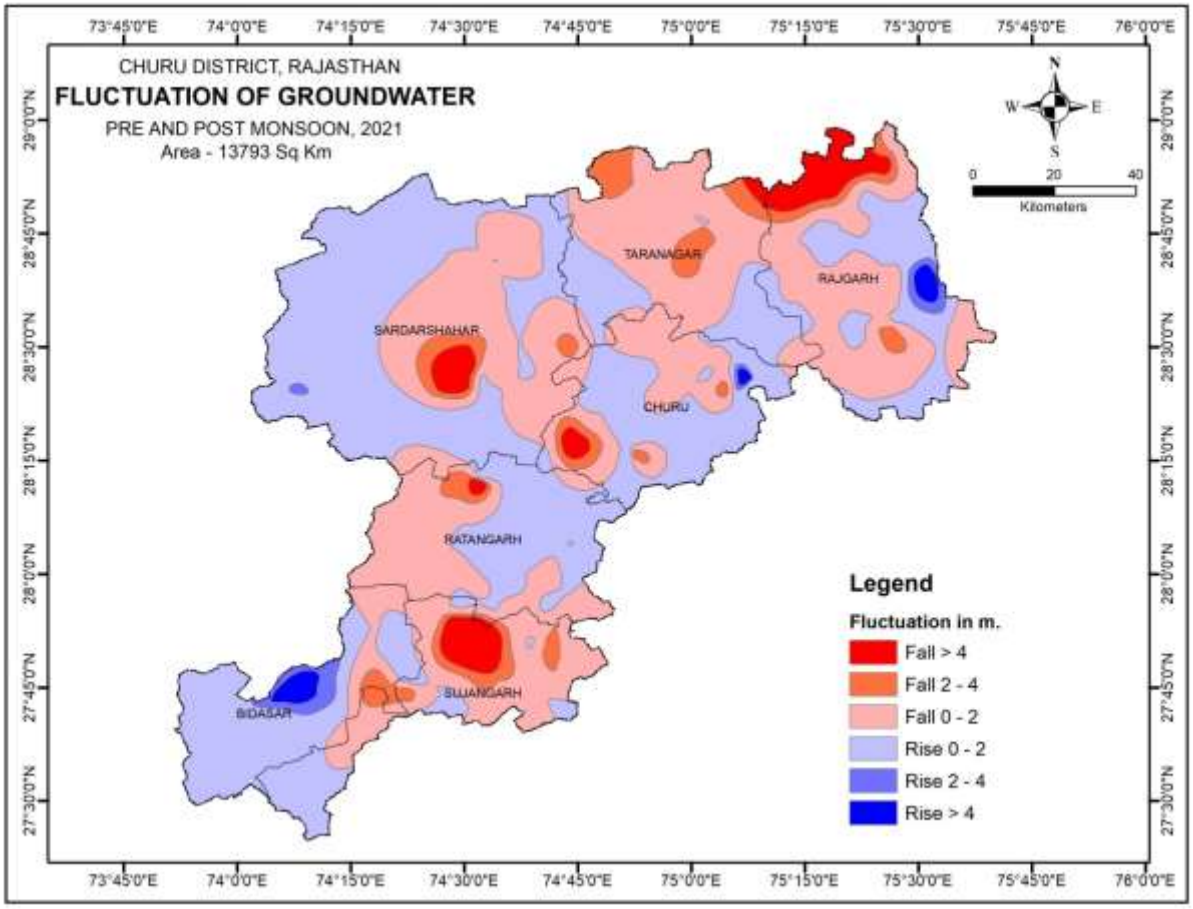


Figure 17 : Water Level Fluctuation Map during Pre and Post Monsoon, 2021 of Churu District.

7.4. Water Level Trend (2011-2020)

For long term trend analysis only those 193 observation points were considered whose consistent 10 years of water level data was available. During pre-monsoon, rise in water level trend has been recorded at 75 stations and ranges from 0.02 (Beeramsar Village, Ratangarh Block) to 7.32 m/year (Sadasar Village, Sardarshahar Block) while falling trend was observed in 118 stations.

Spatially the falling water level trend has been observed in the all part of the district covering almost the entire areal extent of the Sardarshahar, Churu, Rajgarh and Sujangarh Blocks. Rising water level trend on the other hand has been observed in the North – Eastern portions of the district covering parts of Taranagar Blocks and few small pockets in the other Blocks of the district as shownin Figures 23 & 24.

The Fall in the water level trend in the district can be due to the over-exploitation of the groundwater resources than its recharge..

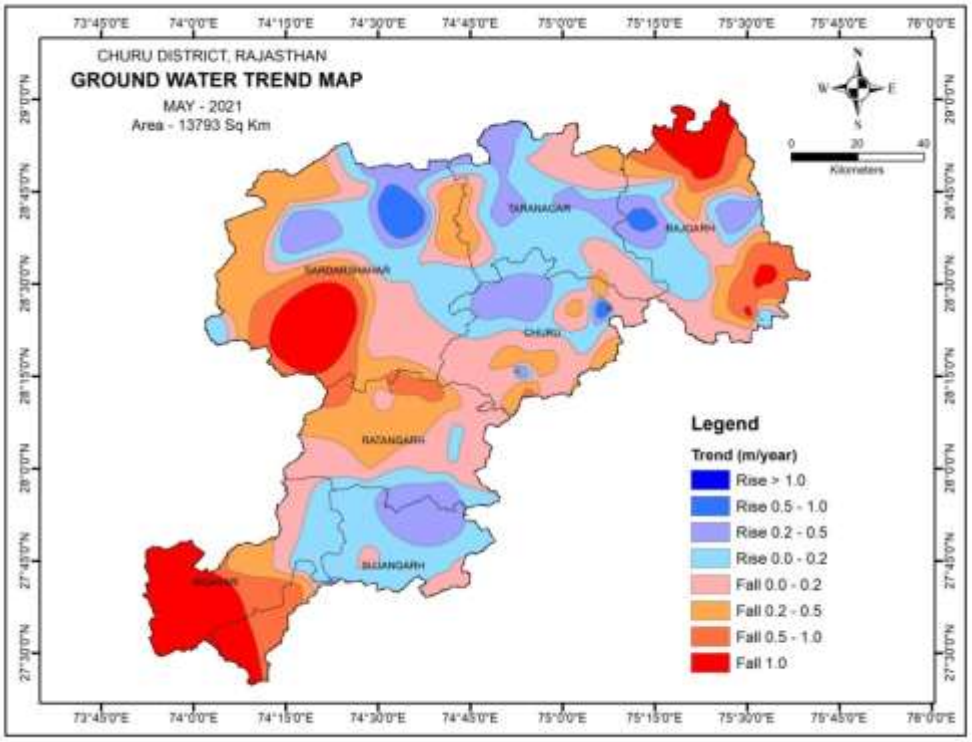


Figure 18 : Pre-Monsoon water level trend of the Churu District

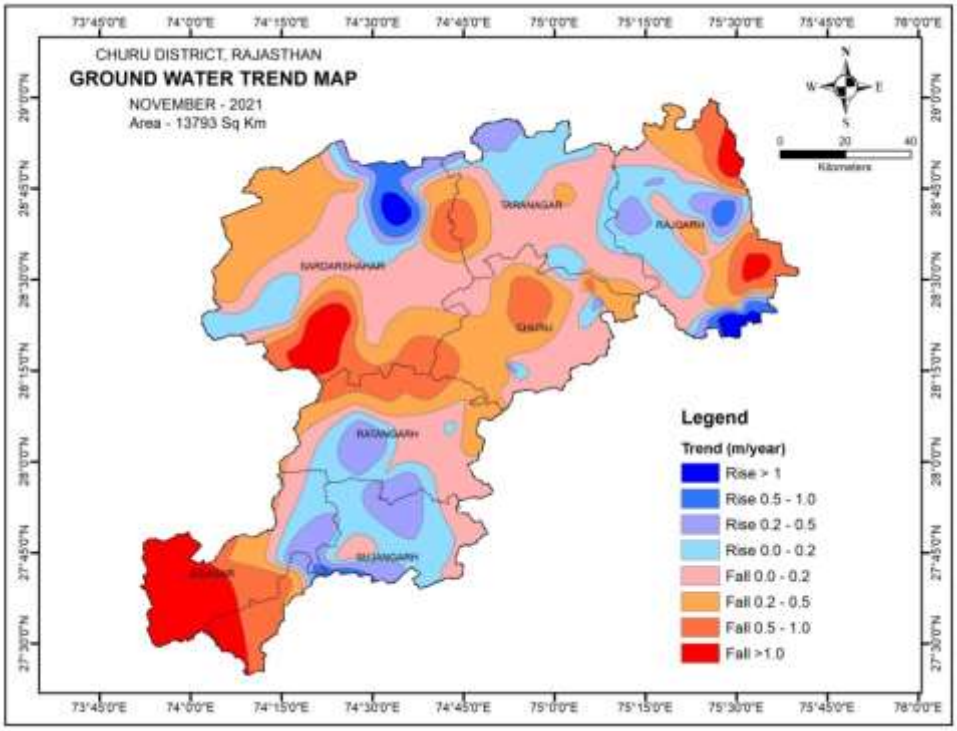


Figure 19 : Post-Monsoon water level trend of the Churu District

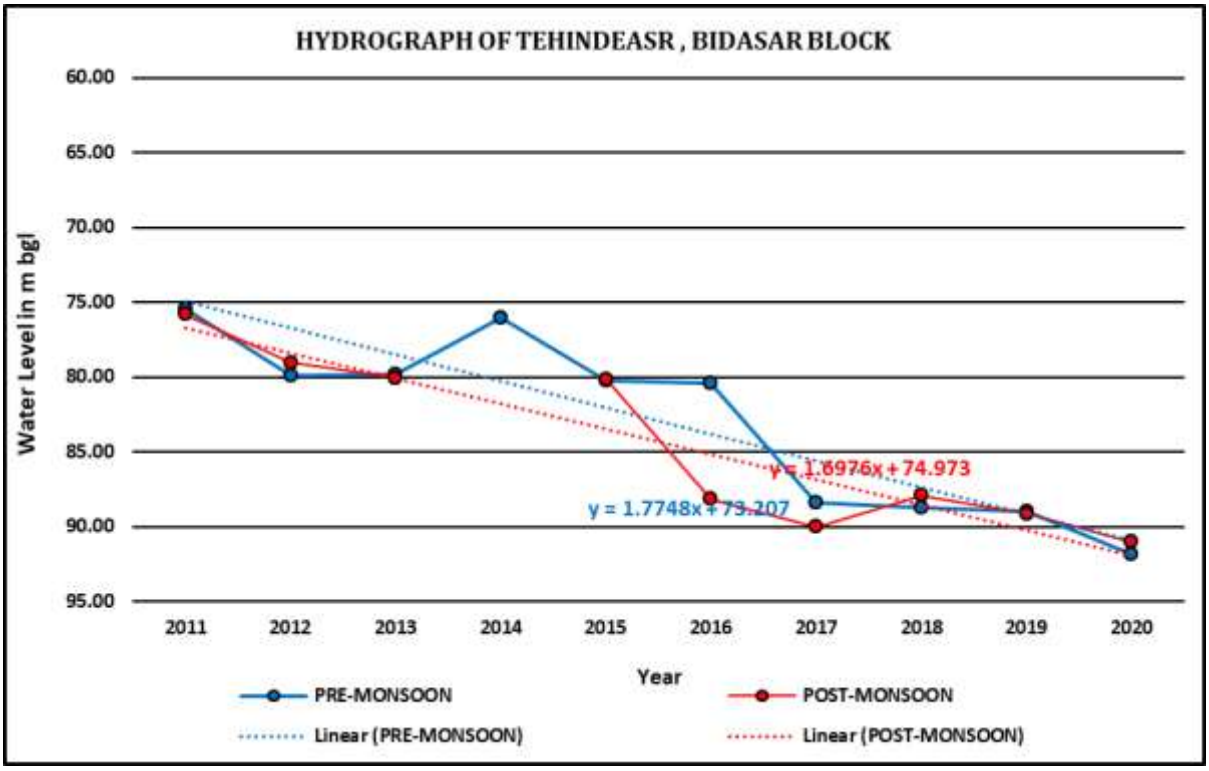


Figure 20: Hydrograph of Tehindesar Village, Bidasar Block, Churu District

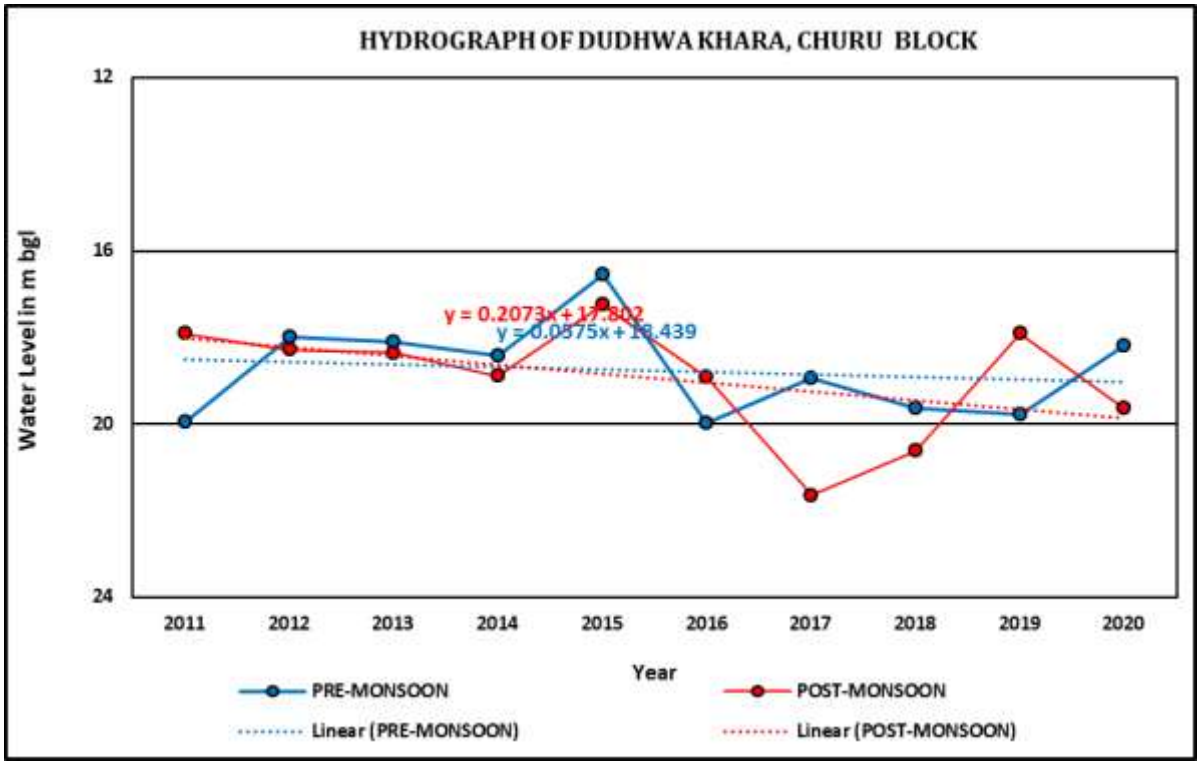


Figure 21: Hydrograph of Dudwa Khara Village, Churu Block, Churu District

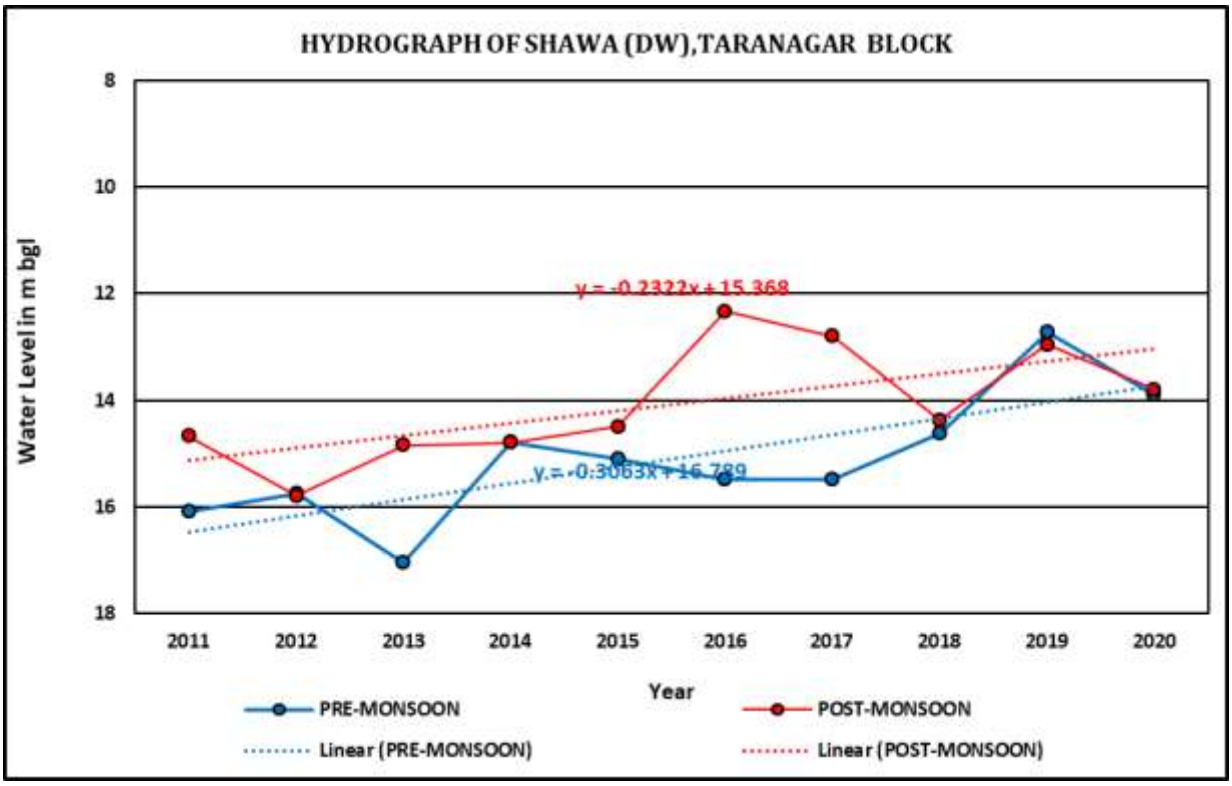


Figure 22: Hydrograph of Shawa Village, Taranaagar Block, Churu District

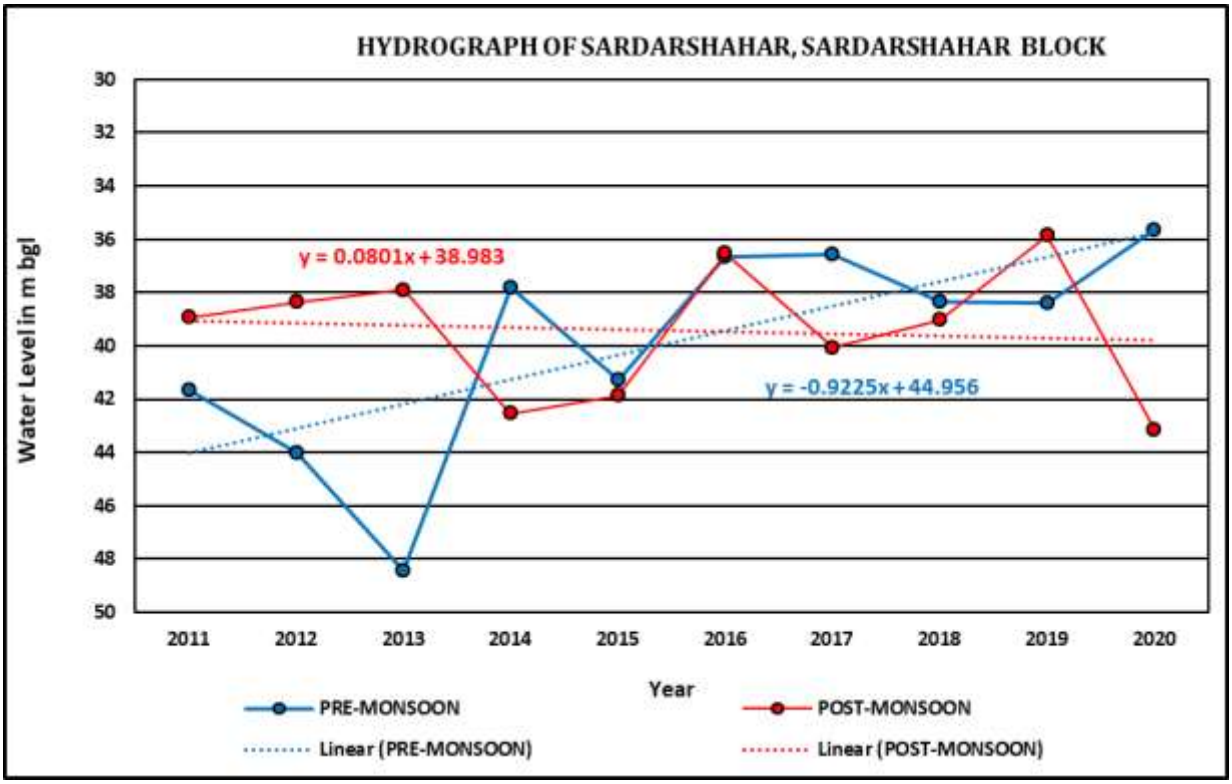


Figure 23: Hydrograph of Sardarshahar, Sardarshahar Block, Churu District

8. Groundwater Quality

In Groundwater assessment studies the quality of groundwater is of great significance. Groundwater study involves a description of the occurrence of the various constituents in groundwater and the relationship of these constituents to water use. The quality of water is defined as its acceptability with respect to its specific uses. In brief, a total of 141 samples (NAQUIM - 113, CGWB – 28) collected during pre-monsoon 2021 were analyzed involving use of different instruments such as pH meter, EC meter, Flame Photometer, UV/ Visible Spectrophotometer and Titrimetric methods, for generating the map and to study the spatial variation of ground water quality (Figure). The concentrations of the variables were reported in milligram per liter (mg/l) except for EC (micro Siemens per centimeter, µS/cm at 25^0C) and pH. This unit of measurement of variable concentrations was converted to meq/l for hydro- geochemical analysis, wherever necessary. The well-wise quality details are presented in Annexure E.

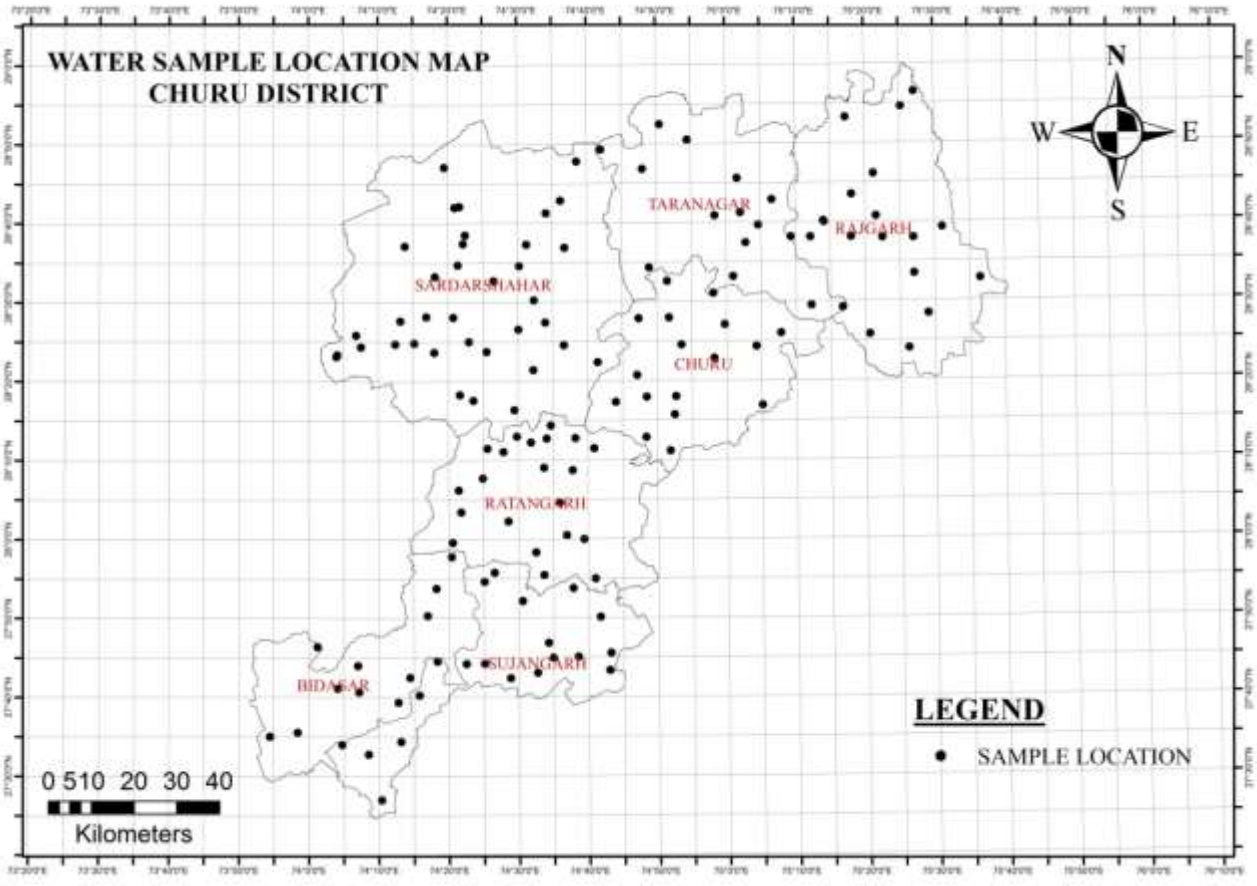


Figure 24: Location Map of the Groundwater Samples of Churu District

The range of hydro geochemical parameters of groundwater and their comparison with the prescribed specification of Indian standard (BIS 2012) are summarized in Table, in order to evaluate the suitability of groundwater for drinking and domestic and public health uses.

It has been observed that most of the hydro geochemical parameters of the groundwater samples in the study area are within the maximum permissible limits and also in not permissible limits, although a number of samples exceed the desirable limits of the Bureau of Indian Standards (BIS).

8.1. Suitability of Ground Water for Drinking Purposes

- **Temperature and pH**

The temperature variation of the samples collected under NAQUIM study ranges from 25ºC to 32ºC with a mean value of 28.85ºC. The pH indicates the strength of the water to react with the acidic or alkaline material present in the water. The acceptable limit of pH is 6.5 - 8.5. The pH in the groundwater is varied from 7.03 to 8.53 with a mean value of 7.73.

- **Electrical conductivity**

It is a measure of total mineral contents of dissolved solids in water. An increase in dissolved solids causes a proportional increase in electrical conductivity. This is a function of temperature and the ionic strength of the solution. The electrical conductivity values of ground water samples in the area is found to vary within the range of 400 to 20560 μS/cm at 25°C with the minimum and maximum valuesbeing found and at Harasar village, Sujangarh Block respectively. Spatial variation map shows that the High electrical conductivity values are noted towards the northern, north-eastern and south-eastern fringes of the district i.e. concentrated mainly in the Taranagar, Sardarshahar, Rajgarh, Churu and Sujangarh blocks . High EC values can also be seen at the sporadic locations usually along the periphery of the Sardarshahar, Bidasar and Sujangarh blocks (Figure).

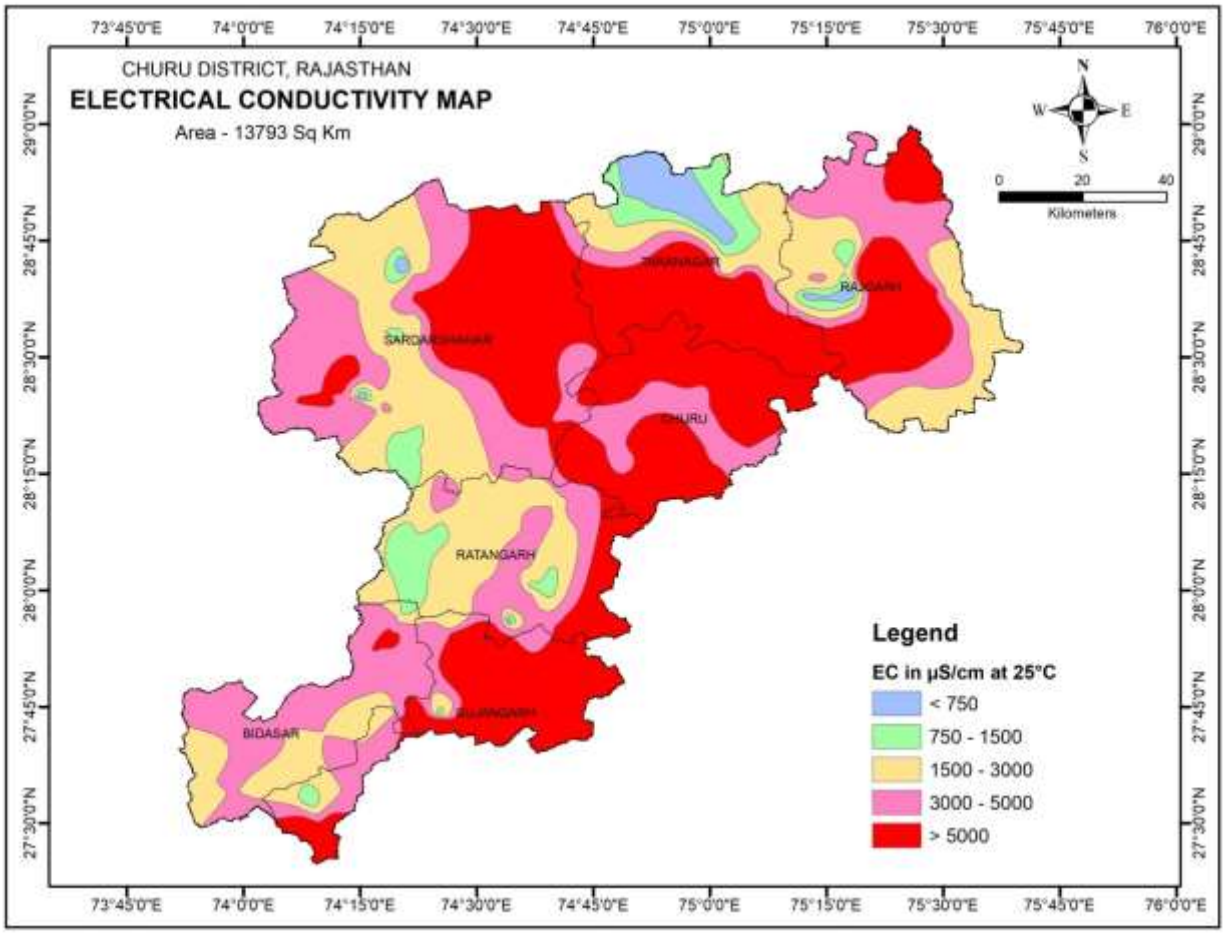


Figure 25 : Electrical Conductivity Map of the Churu District

- **Total Dissolved Solids (TDS)**

Total Dissolved Solids (TDS) in water include all dissolved materials in solution, whether ionized or not. It is numerical sum of all mineral constituents dissolved in water and is expressed in mg/l. The TDS contents of ground water are controlled by the mineral dissolution rate, chemical character of ground water and ionic saturation status of solution. The concentration of total dissolved solids in the ground water has been found to vary generally between 260 mg/l at at Aspalsar village, Sardarshahar Block to 13364 mg/l at Harasar village, Sujangarh Block respectively with a mean vale of 3301.10 mg/l. TDS in 14.89% of analyzed water samples falls in the category of fresh water, while 80.85% samples have TDS in the range of 1000 - 10,000 mg/l , falls in brackish water category and 4.25% samples falls in saline category i.e., 100,00 - 1,00,000 mg/L.

Table 14 : Classification of Water samples based on TDS. (Freeze and Cherry, 1979)

Category	TDS (mg/L)	Number of Samples	Percentage of Samples
Fresh	1000	21	14.89%
Brackish	1000-10000	114	80.85%
Saline	10000-100000	6	4.25%

Table 15 : Ranges of chemical parameters and their comparison with the Indian standards for Drinking Water.

PARAMETERS	BIS Standards for DRINKING WATER (IS 10500 : 2012)		TOTAL NO. OF SAMPLES	Concentration below DL		Concentration between DL & PL		Concentration above PL	
(in mg/L)	DL	PL		NO. OF SAMPLES	%	NO. OF SAMPLES	%	NO. OF SAMPLES	%
pH	**6.5 - 8.5**	**No Relaxation**	**141**	.	**.**	140	**99.3**	1	**0.7**
TDS	**500**	**2000**	**141**	3	**2.1**	55	**39.0**	83	**58.9**
TH	**200**	**600**	**141**	27	**19.1**	47	**33.3**	67	**47.5**
Ca	**75**	**200**	**141**	63	**44.7**	56	**39.7**	22	**15.6**
Mg	**30**	**100**	**141**	35	**24.8**	43	**30.5**	63	**44.7**
Na	**.**	**200**	**141**	.	**.**	17	**12.1**	124	**87.9**
K	**.**	**12**	**141**	.	**.**	94	**66.7**	47	**33.3**
Cl	**250**	**1000**	**141**	28	**19.9**	64	**45.4**	49	**34.8**
SO4	**200**	**400**	**141**	46	**32.6**	26	**18.4**	69	**48.9**
NO3	**45**	**No Relaxation**	**141**	43	**30.5**	.	**.**	98	**69.5**
F	**1**	**1.5**	**141**	71	**50.4**	22	**15.6**	48	**34.0**

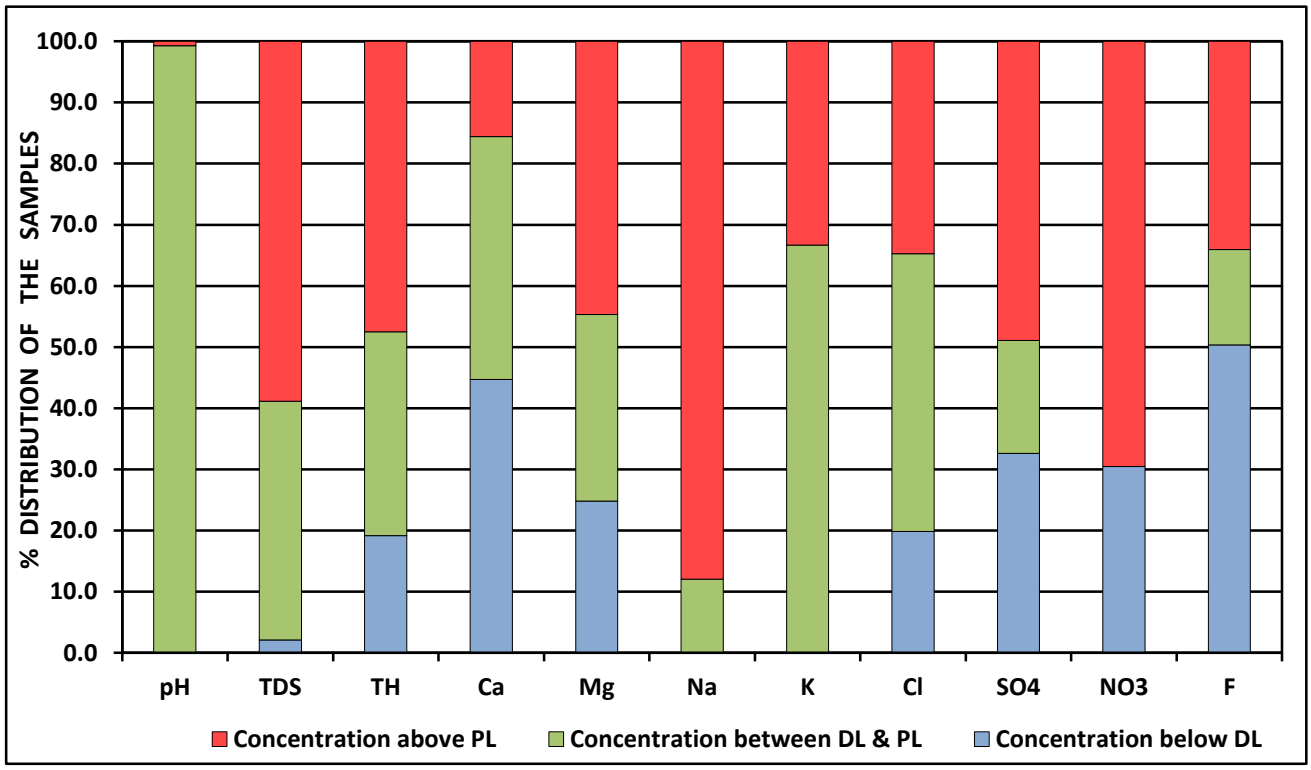


Figure 26 : Percentage Distribution of Ground Water Samples as per BIS (2012) Drinking Water Standards.

- **Nitrate**

Concentration of nitrate (NO_3^-) has been found to vary from 0.52 mg/l at Luhara village in Bidasar Block to 2350 mg/l at Bobasar Village, Sujangarh block. Nitrate concentration exceeds the maximum Permissible Limit of 45 mg/l in drinking water prescribed by BIS (IS-10500:2012) in 69.50% of the total ground water samples. The concentration of nitrate exceeding the permissible limit of 45 mg/l is found to be concentrated in Taranagar, Sujangarh and Sardarshahar Blocks, where the nitrate values are normally above the limit. Higher concentrations of NO^{3-} are attributed to the anthropogenic sources mainly due to the application of more fertilizers and sewage carrying drains. Excess nitrate in drinking water can cause methaemoglobinaemia in infants, gastric cancer, goiter, birth malformations and hypertensions.

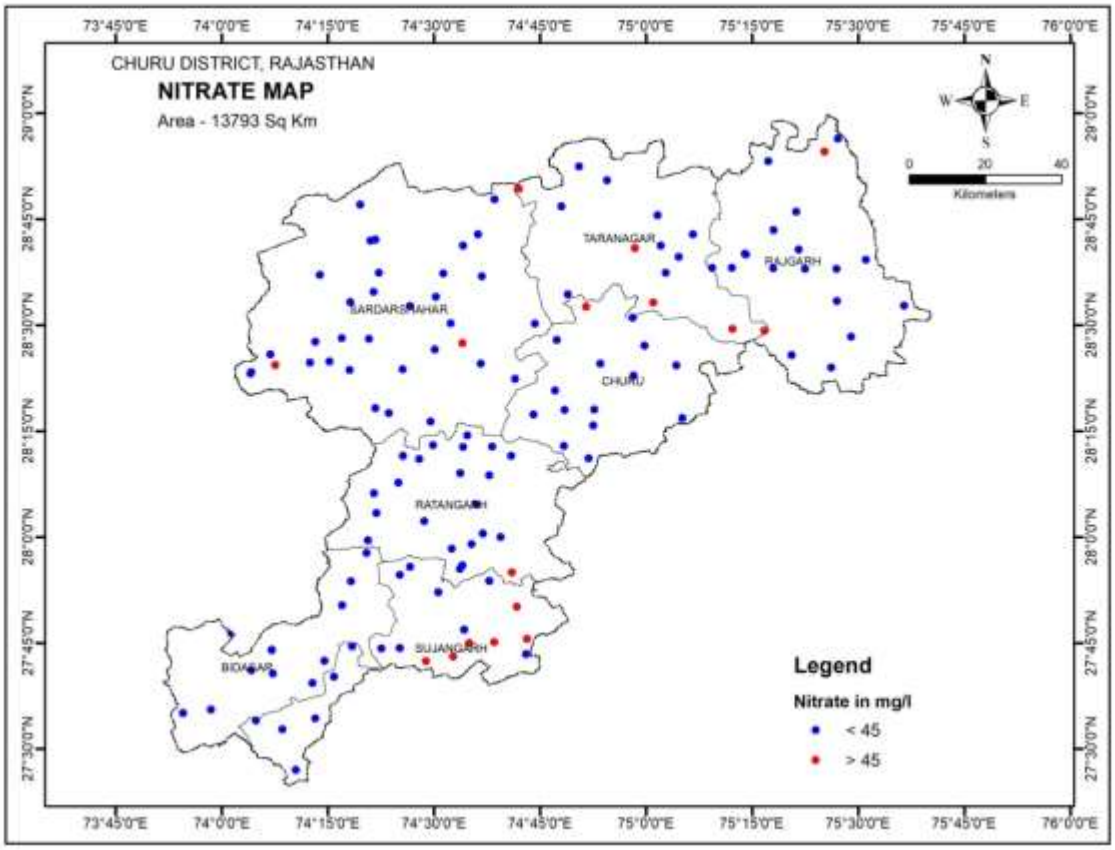


Figure 27 : Nitrate Distribution Map of Churu District.

- **Fluoride**

Fluoride (F^-) is an essential element for maintaining normal development of healthy teeth and bones. However, higher F concentration causes dental and skeletal fluorosis such as mottling of teeth, deformation of ligaments and bending of spinal cord. Concentration of fluoride in ground water samples has been found to vary between 0.00 mg/l in Jasrasar village, Churu block and 17.6 mg/l in Harasar village, Sujangarh Block. With an average value of 2.08 mg/l, 47.51% of samples have F^- concentration within desirable limit of 1 mg/l, whereas it is between desirable and permissible Limits in 18.43% of samples and exceeds the maximum Permissible Limit of 1.5 mg/l (IS-10500: 2012) in 34.04% of the total analyzed samples. Geogenic factors including weathering of rocks containing fluorine bearing minerals like fluorite, apatite and micas is the major source of fluoride contamination in the area under observation.

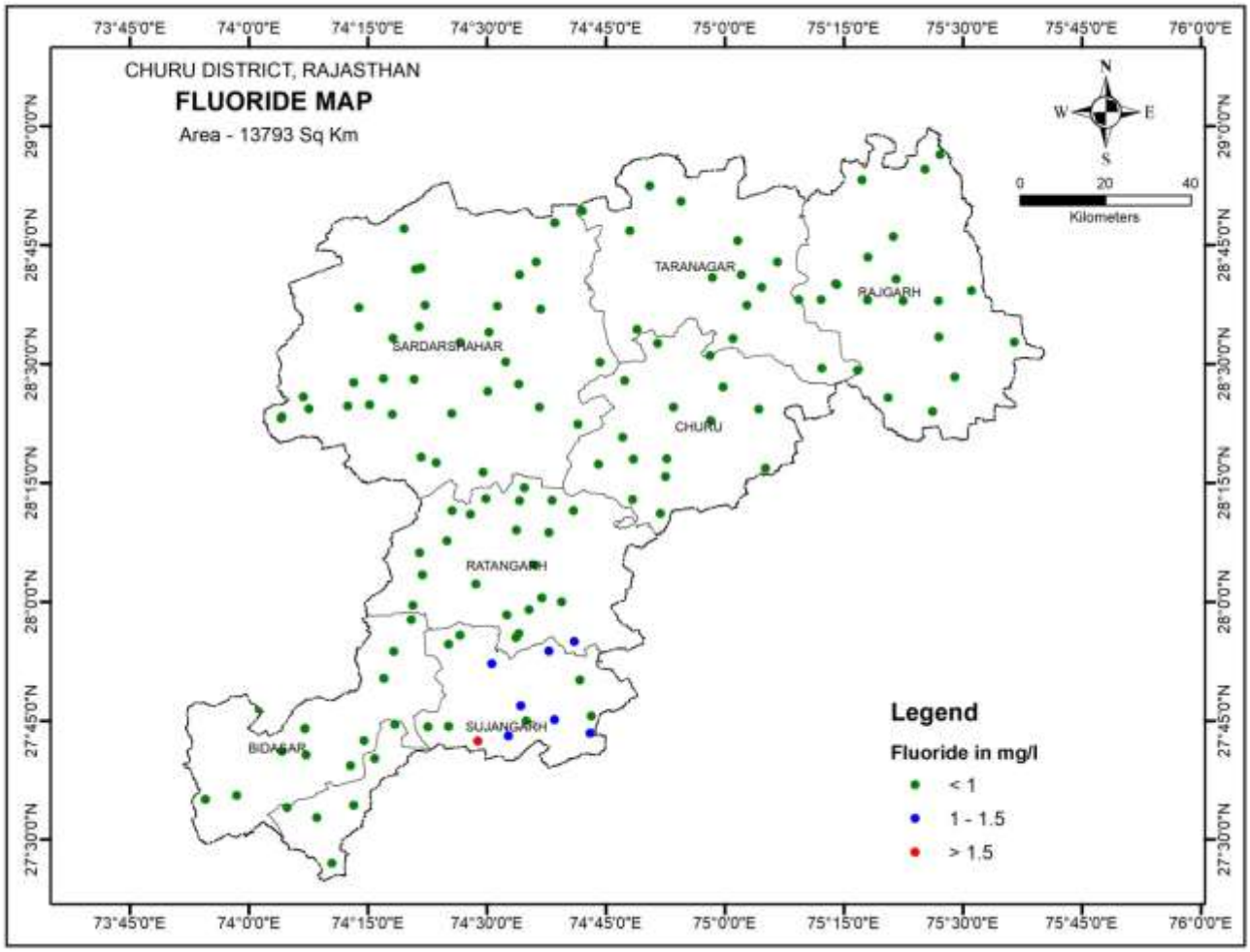


Figure 28 : Fluoride Distribution Map of Churu District

- **Uranium**

In the present study under NAQUIM an attempt has been made to evaluate the uranium concentrations in drinking water samples collected from seven blocks of the Churu district. Estimation of uranium has been done by using LED Fluorimeter instrument. World Health organization (WHO) assumes that uranium content up to 30µg/l can be tolerated in drinking water. For Uranium analysis 124 samples were collected during 2021 pre monsoon under NAQUIM study. It was observed that in 68.54% samples the concentration measured is within the guideline value defined by the WHO and about 31.45 % of samples U-concentrations exceed 30 $\mu g l^{-1}$ value (Figure). Data analysis also reveals that in 21.77% samples U-concentrations exceed the threshold of 60 $\mu g l^{-1}$ recommended by AERB, DAE, India, 2004 (Figure). To understand the effect of high uranium concentration on human health still requires extensive field work and interaction with the people and collaboration with the health institutes. The higher concentrations observed in ground water samples from Sujangarh Block might be due to leaching of uranium from adjoining hardrock formations that includes Schist, Gneiss, Limestone etc. and intrusive like Erinpura granites. Other causes for higher U-concentrations in water sample may be due declining water level. The anthropogenic activities urbanization and wide spread use of pesticides/fertilizers which is responsible for increase in the TDS/ salinity of the region might also are another cause. But, overall it is evident that the plausible source of high uranium observed in this region may be of geogenic in nature.

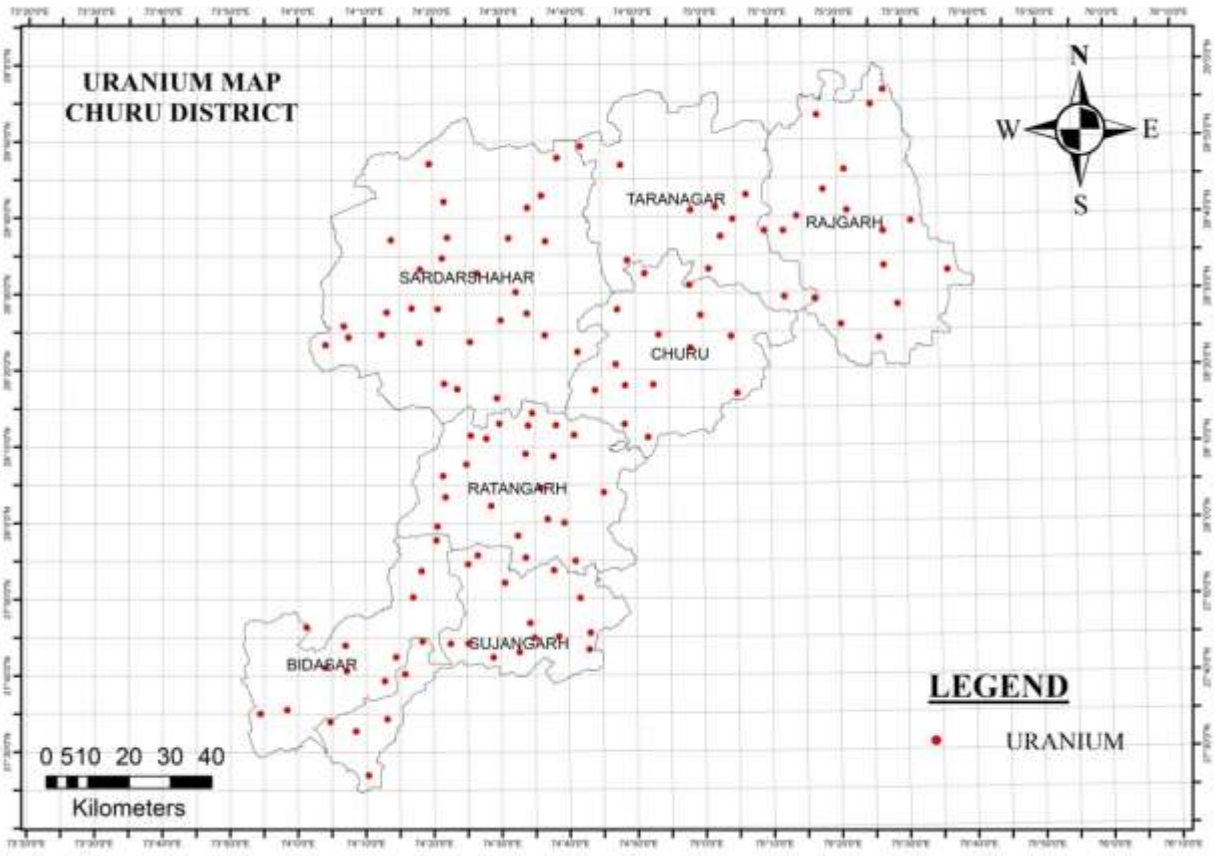


Figure 29 : Uranium Distribution Map of Churu District

- **Total Hardness**

Total hardness has been found to vary between 110 mg/l and 3400 mg/l, indicating moderately hard to very hard type of ground water. High hardness may cause precipitation of calcium carbonate and encrustation on water supply distribution systems. Long term consumption of extremely hard water might lead to an increased incidence of urolithiasis, anencephaly, parental mortality and cardio-vascular disorders. In the district, Total Hardness exceeds the recommended maximum Permissible Limit of 600 mg/l (IS- 10500: 2012) in 47.51% of total analyzed ground water samples, while 36.17% of the sample are within thedesirable limit of 200 - 600 mg/l. Total hardness in excess of the maximum Permissible Limit has been reported from all blocks of the district.

8.2. Suitability of Ground Water for Irrigation Purposes

The ground water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The quality of irrigation water depends primarily on the presence of dissolved salts and their concentrations. The Electrical Conductivity (EC), Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which influence the water quality and its suitability for irrigation. The quality of groundwater based on EC and SAR is discussed in Table 16 .

Table 16: Classification of groundwater quality based on suitability of water for irrigation purposes

Parameter	Class	Range	Groundwater Class (Irrigation Uses)	Number of Samples	Percent of Samples
Salinity Hazard (Richards,1954)	**C1**	**< 250**	**Excellent**	-	-
	C2	**250 - 750**	**Good**	3	2.12
	C3	**750 - 2250**	**Permissible**	34	24.11
	C4	**2250 - 3000**	**Doubtful**	20	14.18
	C5	**> 3000**	**Unsuitable**	84	59.6
SAR (Wilcox,1955)	**S1**	**< 10**	**Excellent**	62	43.9
	S2	**10 - 18**	**Good**	45	31.9
	S3	**18 - 26**	**Doubtful**	19	13.4
	S4	**> 26**	**Unsuitable**	15	10.63
Na% (Wilcox,1955)		**< 20**	**Excellent**	-	-
		20 - 40	**Good**	06	4.25
		40 - 60	**Permissible**	39	27.6
		60 - 80	**Doubtful**	63	44.6
		>80	**Unsuitable**	33	23.4
Residual Sodium Carbonate (RSC) (Eaton 1950; Wilcox et al. 1954)		**< 1.25**	**Safe**	100	70.9
		1.25 - 2.5	**Marginal**	12	8.5
		> 2.5	**Unsuitable**	29	20.5

High saline water cannot be used on soils with restricted drainage and requires special management for salinity control. Plants with good salt tolerance should be selected for such areas. Very high saline water is not suitable for irrigation under ordinary conditions but may be used occasionally under very special circumstances. The soil must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching and salt tolerance crops/plants should be selected.

Sodium Adsorption Ratio (SAR): High concentration of sodium in water produces undesirable effects of changing soil properties and reducing soil permeability and thus reduces the supply of water needed for the crops. It is calculated from the ratio of sodium to calcium and magnesium by the following formula:

$$\mathbf{SAR= Na^{+}/ [(Ca^{2+}+Mg^{2+})/2]^{0.5}}$$ where all ionic concentrations are expressed in meq/l.

Cumulative effect of salinity and sodium hazard in the study area can be study by plotting sodium-absorption ratio and electrical conductivity (Figure 39) data on US Salinity Laboratory diagram (USSL, 1954).

Sodium Percent (Na %): The sodium in irrigation waters is usually denoted as percent of sodium. According to Wilcox (1955), in all natural waters Na% is a common parameter to assess its suitability for irrigational purposes. The sodium percent (Na %) values were obtained by using the following equation:

$$\mathbf{Na\%= [Na^{+}+K^{+}] \times 100/ [Ca^{2+}+Mg^{2+}+Na^{+}+K^{+}]}$$ all ionic concentrations are expressed in meq/l.

Low sodium (alkali) water can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. Medium sodium water will present an appreciable sodium hazard in fine textured soils having high cation exchange capacity especially under low leaching conditions. This water can be used on coarse textured or organic soils with good permeability.

Residual Sodium Carbonate (RSC): Residual Sodium Carbonate (RSC) has been used to determine the harmful effect of carbonate and bicarbonate on the quality of water for agricultural purpose and is estimated by the formula.

RSC = $(HCO^{-3}+CO^{-3}) - (Ca^{2+}+Mg^{2+})$ where all ionic concentrations are expressed in meq/L.

According to the RSC classification for irrigation purposes, the water samples with values greater than 2.5 meq/l are unsuitable for irrigation. Groundwater of the study area is classified on the basis of RSC and is presented in Table.

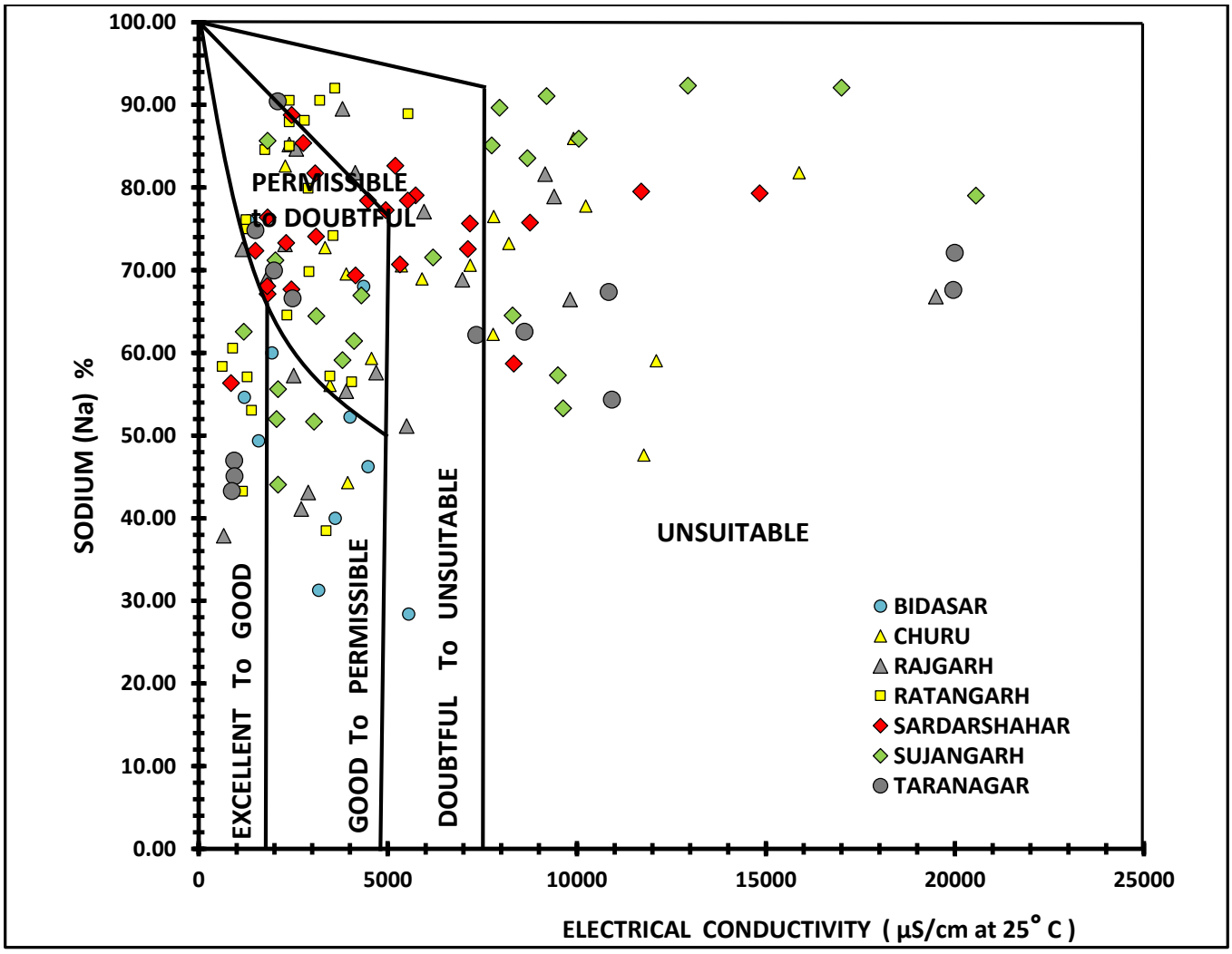


Figure 30 : Wilcox diagram showing variation of salinity hazard and sodium hazard of the study area.

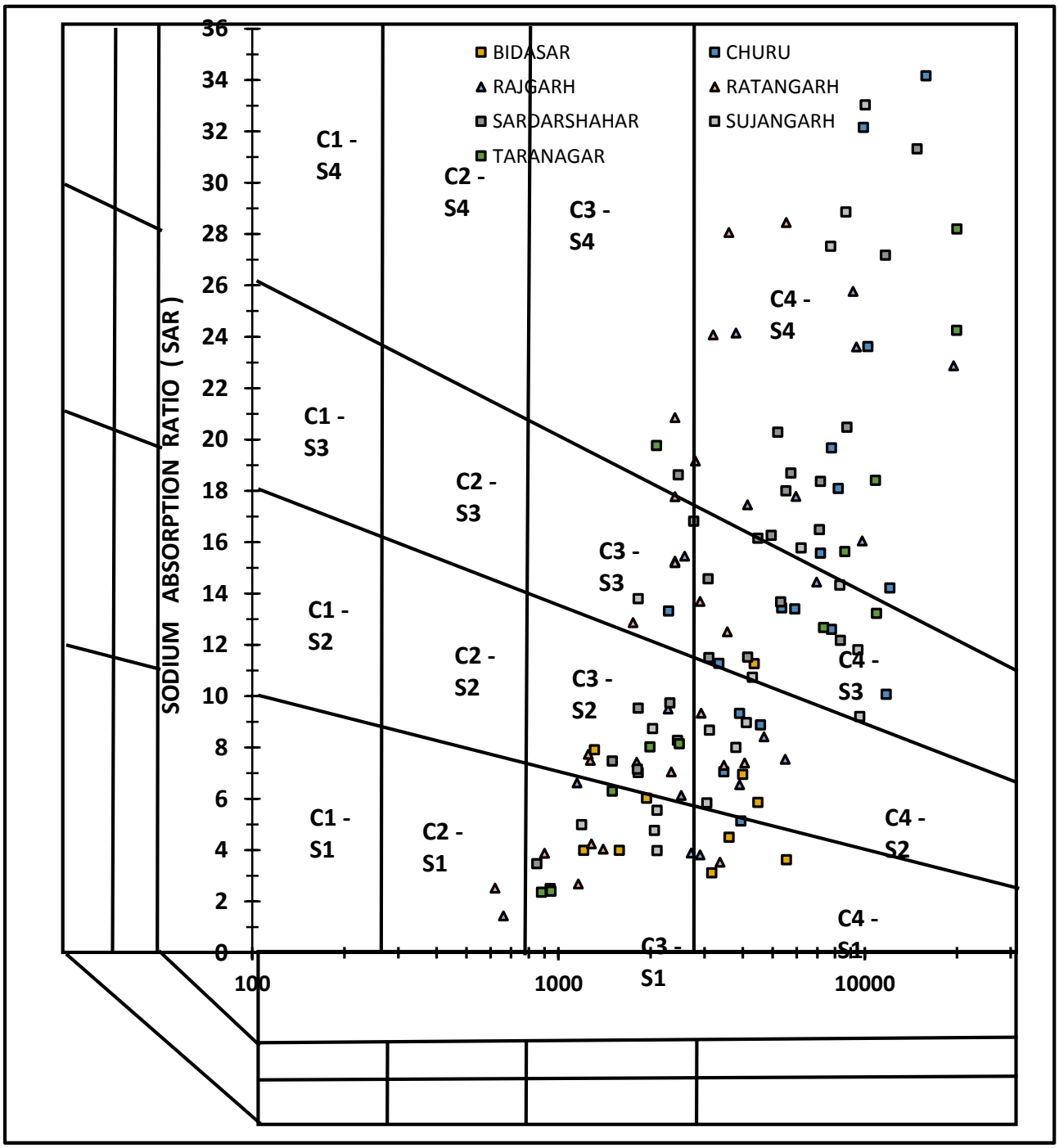


Figure 31 : USSL diagram showing variation of salinity hazard and sodium hazard of the study area.

8.3. Heavy Metals

To understand the presence of the heavy metals in the groundwater and to also analyze the effect of the pollution due to the industries and mining activities in the district a total of 123 samples were collected and analyzed for six heavy metals (Table), To decide the suitability of groundwater for drinking purpose the standards proposed by the Bureau of Indian Standards (BIS) for drinking water (IS- 10500:2012) were used. The results of analysis of heavy metals are given in Annexure F.

Table 17 : The concentrations of Heavy Metals in groundwater samples of Churu District

Parameters	BIS : 2012		Total number of Samples	Samples < DL		Samples between DL and PL		Samples > PL	
	DL	PL		Number of Samples	%	Number of Samples	%	Number of Samples	%
Fe (mg/l)	1	No Relaxation	123	120	97.56	.	.	3	2.43
Cu (mg/l)	0.05	1.5	123	119	96.74	4	3.25	.	.
Mn (mg/l)	0.1	0.3	123	120	97.56	3	2.43	.	.
Zn (mg/l)	5	15	123	123	100	.	.	.	.
Pb (mg/l)	0.01	No Relaxation	123	122	99.18	.	.	1	0.81
Ni (mg/l)	0.02	No Relaxation	123	123	100.00	.	.	.	.

Fe: Iron is the most commonly available metal on earth. During the study, Iron content in ground water samples varied from below detection limit (BDL) to 4.6 mg/l with the maximum value being found at Abasar village of Sujangarh block. Out of the total samples collected, 97.56 % of the samples have iron content within the permissible limit and only 2.43 % exceeds the limit.

Cu: In the study area Cu varies from BDL to 0.191 mg/l with nearly 96.74 % of samples are found within the desirable limit and the rest 3.25 % samples fall between desirable and permissible limit and no samples exceeding the permissible limit. The maximum value of 0.191 mg/l was observed at sampling site Malsisar village in the Sujangarh Block.

Mn: In study area of Churu district, the value of Mn varies between BDL to 0.143 mg/l with the maximum value being observed at Inyara village of Bidasar Block. However, out of the total groundwater samples 97.56 % water samples are within the desirable limit, 2.43 % of the sample falls between desirable and permissible limit and no samples exceeding the permissible limit.

Zn: The desirable limit of Zinc is 5.0 mg/l and out of 123 samples no sample exceeds the desirable limit. The maximum value of 0.904 mg/l was observed at sampling site Bheegran village in the Taranagar Block.

Pb & Ni: Both Lead & Nickel are highly toxic metals and they should normally be present only within traces. In the Churu district, the concentrations of Pb were found to be higher than their acceptable limits of BIS, i.e. Pb (0.01mg/l) in only one sample, whereas the concentrations of Ni were within the acceptable limit in all the samples.

9. Groundwater Related Issues

9.1. Over Exploitation of groundwater

The present stage of development in the 4 blocks of the district is categorized as Over Exploited, 1 block categorized as Critical and 1 block is Safe. Taranagar Block is categorized as exclusively Saline. The stage of development has sharply increased in Bidasar, Churu, Rajgarh, Ratangarh and Sujangarh blocks as compared to 2017 in 2020 (Figure). The main reason for increase in stage of groundwater development is overdraft for irrigation purpose. The declining trend of stage of groundwater extraction is being observed in Churu and Ratangarh blocks. The total draft in the district has increased from 127.58 mcm in 2017 to 134.10 mcm in 2020 which shows the increase of 105.11 % from 2017 to 2020.

9.2. Declining Water Level Trend (2011-2020)

The analysis of decadal water level trend (2011 – 2020) indicates that the district has significant areas that had undergone a declining water level trend over the years. The decline trend in Pre-Monsoon season is observed in 50 % of the district area covering the Bidasar, Churu, Ratangarh and Rajgarh Blocks with few pockets in the other blocks.

9.3. Limited sub surface storage availability and No Surface Runoff

There is limited sub surface space available for storage of groundwater as the entire district is covered up by alluvium but limited potential zone for recharge and less rainfall is also major issue.

9.4. Quality of Groundwater

The quality of groundwater is also an issue mainly in the western part of the district with the EC exceeding the values of 2250 and even 3000 μS/cm in all parts of district especially in Sujangarh, Tarnagar, Churu and Rajgarh blocks. Apart from the high salinity values, the Nitrate concentrations is also a major quality issue in the area with nearly 70% of the samples exceeding the permissible limit of Nitrate in the districtcovering almost the entire spatial area.

10. Groundwater Resources

The Groundwater resources have been reassessed in 2020 based on the methodology recommended by Groundwater Estimation Committee (2015). The block wise resources for Churu district are given in Table. Perusal of data indicates that all the 4 blocks falls under Over Exploited category, 1 block falls under Critical category and 1 block falls under safe category with stage of ground water development of the district being 115.49 %, with Sardarshahar block having the lowest stage of development of 59.24 % and the Rajgarh block having the highest with value of 304.43 %.

Due to over development of groundwater further exploitation of this precious resource must be checked. Artificial recharge is a difficult task in the district as no surface runoff, very low rainfall and storage capacity is low. Since the stage of ground water development has already crossed 100%, for sustainable utilization of water resources conjunctive use of surface and groundwater is inevitable.

10.1. Supply Side Management

The supply side management of ground water resources is proposed based on availability of surplus surface water within river sub basins and micro watersheds and their artificial recharge in unconfined aquifers. The feasibility of the area for recharge, specific yield of the aquifer, the unsaturated volume of the aquifer, the aquifer thickness as well as the unsaturated depth below 3mbgl is also taken into consideration during artificial recharge. In Churu district it has been founded that artificial recharge is not feasible, because of no surface water surplus. Hence it is proposed to promote rain water harvesting through storage structures like Tankas. In the Churu district total 25592 proposed for rainwater conservation stored 1.2796 mcm water.

10.2. Demand Side Management

The demand side management includes water saving by using interventions such as use of sprinkler irrigation in the areas where Rabi crop is being irrigated through ground water and changing the area under more water intensive i.e. wheat crop to gram. The water saving by adopting micro irrigation practices as well as the change in cropping pattern has been

proposed in all the blocks of the district for the sustainable development of the groundwater.

Even though after implementation of supply side management options in the current scenario, the water saving is still less to compensate the withdrawal. So, there is a need of adopting micro-irrigation techniques for water intensive crops or change in cropping pattern or both are required to save water.

It can be seen that hardly any enhancement in ground water resources can be conserved through artificial recharge due to constraints of availability of surplus/non-committed surface water. However, considerable improvement in ground water situation can be achieved with implementation of the suggested demand side management interventions.

The micro-irrigation techniques viz. sprinkler or drip irrigation, which are proposed to be adopted in 1355.59 km^2 area of the district which can save a total of 108.45 mcm water. Similarly, if the 50% of cropping area under wheat cultivation be changed to gram crop it can save water up to 16.80 mcm (Table 21 & 22).

Block	Net Irrigated Area through Ground Water (DW+TW)	Gross Irrigated Area through Ground Water (DW + TW)	50% of Gross Irrigated Area Changed to Sprinkler Irrigation	Water Saving Through Sprinkler Use in mcm
Bidasar	39071	61154	30577	24.4616
Churu	5582	5871	2935.5	2.3484
Rajgarh	12474	22103	11051.5	8.8412
Ratangarh	23300	39225	19612.5	15.69
Sardarshahar	64737	117875	58937.5	47.15
Sujangarh	13429	24399	12199.5	9.7596
Taranagar	0	492	246	0.1968
District	**158593**	**271119**	**135559.5**	**108.45**
**Area In Hectare*	**DW = Dug Well*	**TW = Tube Well*	**Source : Ground Water District Outline*	

Table 18: Block-wise proposal for adopting Micro-Irrigation in Churu District

Table 19: Block-wise proposal for Crop Change and Water Saving in Churu District

Block	Area Under Wheat	50% of Area Under Wheat Changed to Gram	Water Saving ThroughCrop Change in mcm
Bidasar	7214	3607	3.607
Churu	2090	1045	1.045
Rajgarh	4552	2276	2.276
Ratangarh	6400	3200	3.2
Sardarshahar	10288	5144	5.144
Sujangarh	1490	745	0.745
Taranagar	1567	783.5	0.7835
District	**33601**	**16800.5**	**16.80**
**Area In Hectare*			**Source : Ground Water District Outline*

10.3. Expected Benefits

The impact of groundwater management plans on the groundwater system in the district after its implementation is evaluated and the outcome shows significant improvement in groundwater scenario inall blocks as given in the Table. After implementation of interventions the total Stage of Groundwater Extraction will improve from 115.49 % to 70 %, i.e., a significant change of one third of the original value can be achieved.

Table 20 : Block-wise Proposal of Water Conservation Structures in Churu District

Block	Geographical Area of Block (sq km)	Hilly Area (sq km)	Potential Area (sq km)	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	Tanka (Nos.) (Capacity 50,000 liters)
Bidasar	1138.78	0	902.04	628.8	2592

Churu	1606.87	0	484.38	1144.9	3248
Rajgarh	2224.92	0	324.25	846	5792
Ratangarh	1622.41	0	1045.3	596.5	3242
Sardarshahar	3860.8	0	2123.76	1175.1	4840
Sujangarh	1528.83	0	312.07	860.7	2689
Taranagar	1810.4	0	0	1059.4	3191
District	**13793**	**0**	**5191.8**	**4590.38**	**25592**

Table 21 : Block-wise Proposal of Water Conservation Structures in Churu District.

Block	Annual Extractable Ground Water (mcm)	Current annual gross ground water extraction for 'All Uses' (mcm)	Present Stage of GW Extraction %	Water stored in Tanka Structure (mcm)	Projected Stage of GW Extraction % after Supply Side Interventions	Additional Water Availability after Demand side interventions	Gross ground water extraction for 'All Uses' after Demand side inteventions (mcm)	Projected Stage of GW Extraction % after Demand side inteventions
Bidasar	25.30	36.40	143.85	0.13	143.33	24.46	11.80	46.65
Churu	9.84	9.66	98.15	0.16	96.50	3.39	6.11	62.04
Rajgarh	9.99	30.41	304.43	0.29	301.53	11.12	19.00	190.22
Ratangarh	21.03	21.97	104.47	0.16	103.70	7.85	13.96	66.40
Sardarshahar	43.71	25.90	59.25	0.24	58.69	0.00	25.66	58.69
Sujangarh	6.23	9.77	156.69	0.13	154.53	4.88	4.75	76.24
Taranagar	-	-	-	0.16	-	-	-	-
District	**116.11**	**134.10**	**115.49**	**1.28**	**114.39**	**51.70**	**81.28**	**70.00**

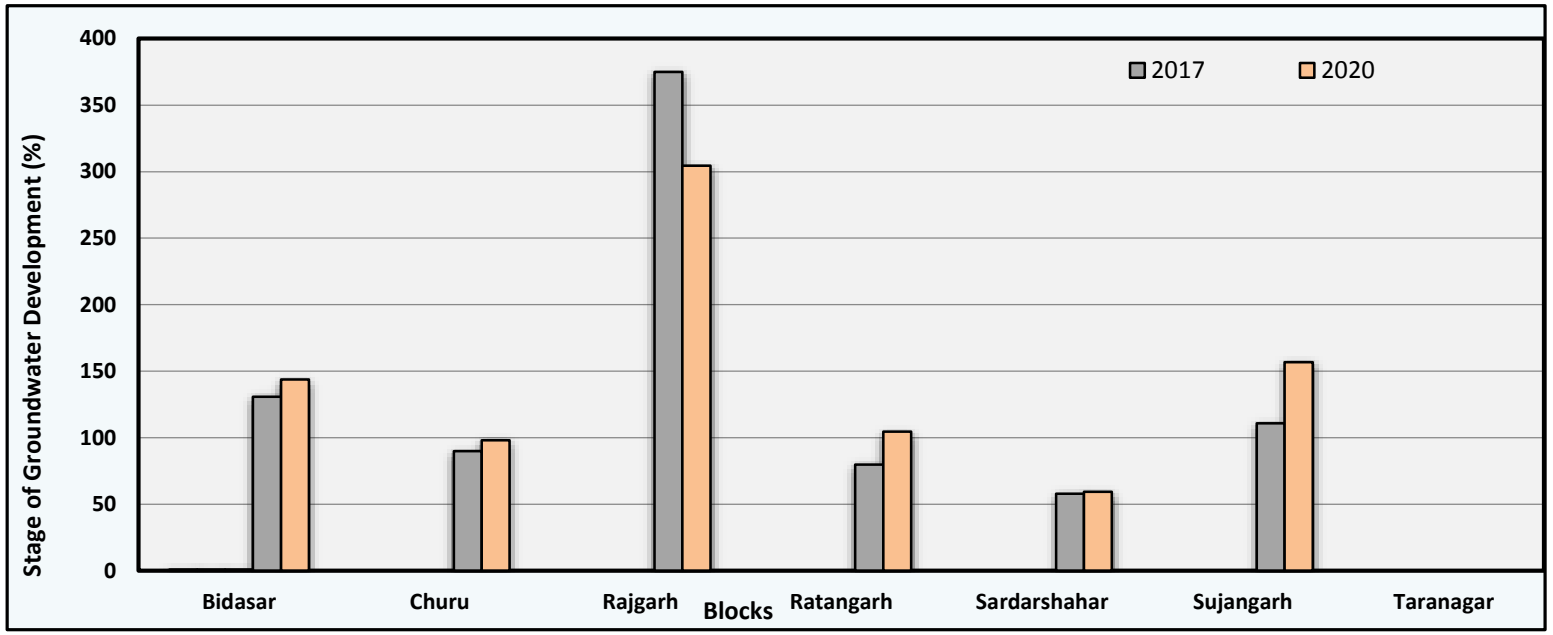


Figure 32 : Block wise Stage of Groundwater Development through the years in Churu District.

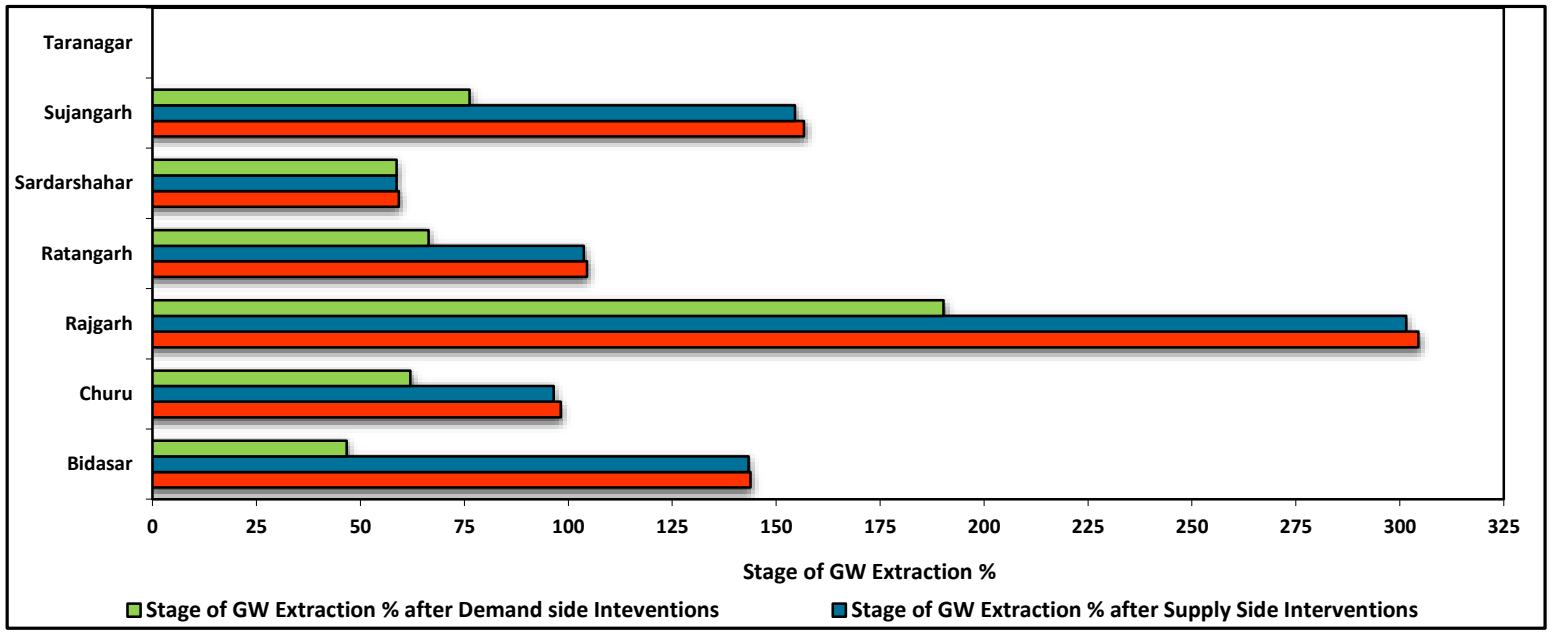


Figure 33 : Expected Change in Stage of Ground Water Extraction after Proposed Interventions.

11. Public Interaction Programmes (PIPs) under the NAQUIM Study in the field area of CHURU District, Rajasthan.

Public Interactions Programs with the locals of the district were held at Bobasar, Tamba Kheri and Udsar Lodera Village Panchayats of the district. The motive of these programs was to understandthe ground reality of the groundwater conditions in the district and also to educate and encourage the locals about the management and conservation of groundwater resources in the future. The field photos of the interaction programs are depicted in Figure 47.

Figure 34: Photographs of PIP Conducted in Churu District.

12. Recommendations

- The interventions discussed above needs to be implemented to bring down the Stage of Ground Water Development down and put a halt to further decline of ground water levels.

- The interventions above need to be supported by regulation on extraction from deeper aquifer. So, the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought.

- In terms of the critical issues for the drinking water such as source sustainability, water quality management and better operation and maintenance, it is important that strong grassroots awareness is generated. Thus, IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory ground water management.
- Farmers should be trained for adopting more efficient irrigation techniques and water conservation practices and boosting recharge. Awareness among stakeholders & their participation for ground water recharge and conjunctive use of available resource. Farmers should be trained for adopting more efficient irrigation techniques and water conservation practices and boosting recharge.
- Sustainable management of the area is required to be taken off to improve the quality and quantity of the groundwater and regular monitoring is therefore recommended.
- Exploration of the deeper aquifers should be emphasized in the future specially in the Hard rock area in the Bidasar, Sujangarh, and Ratangarh Blocks and along the Periphery of the Sardarshahar Fault passing through Sardarshahr blocks of the district, with the probability of developing a major source of groundwater development source that can be utilized as a conduit of fresh water forirrigation and drinking purposes of the district.
- It is also suggested that the identification of potential zones in saline area for the artificial recharge.

13. BLOCK-WISE AQUIFER MAPS AND MANAGEMENT PLANS

- BIDASAR BLOCK.
- CHURU BLOCK.
- RAJGARH BLOCK.
- RATANGARH BLOCK.
- SARDARSHAHAR BLOCK.
- SUJANGARH BLOCK.
- TARANAGAR BLOCK.

Salient Information	Block - Bidasar	
	Geographical Area (sq. km)	1138.78
	Forest Area (sq. km)	3.76
	Potential Area (sq. Km)	902.04
Climate & Rainfall	Climate	Hot and Dry
	Average Rainfall (1990-2019)	407 mm
Aquifer System	Aquifer Characteristics	Limestone Sandstone
	Main Aquifers in the area	Limestone/Sandstone
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	Limestone - 0.040 Sandstone – 0.040
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	74.61
	Trend (m/yr)	0.50
Ground Water Quality	General	
	Electrical Conductivity in microS/cm	1500
	Chloride in mg/litre	156
	Nitrate in mg/litre	29
	Fluoride in mg/litre	0.60
Groundwater Resources	Total annual ground water recharge(mcm)	28.1129
	Natural discharge during non-monsoon season(mcm)	2.8113
	Net ground water availability(mcm)	25.3016
	Existing gross ground water draft for irrigation(mcm)	32.694
	Existing gross ground water draft for domestic & industrial uses(mcm)	3.70111
	Existing gross ground water draft for all uses(mcm)	36.39511
	Allocation for domestic & industrial requirement(mcm)	3.70111
	Net ground water availability for future irrigation development(mcm)	0

	State of ground water development	143.85
	Category	Over-exploited
Supply Side Management	Geographical Area of Block (Sq.km.)	1138.78
	Potential area suitable for recharge (Sq.km.)	902.04
	Thickness of unsaturated zone 3 m below ground level (m)	71.61
	Volume of sub surface storage space available for artificial recharge (MCM)	1291.90
	Surplus Runoff Availability	0
	Tanka Structures Proposed for water conservation	2592
Demand side Management	Use of Advanced Irrigation Practices to be promoted	
	(i) Micro-irrigation	
	Total Irrigated Area (ha)	61154
	Irrigated Area (ha) proposed for micro-irrigation	30577
	Water Saving by Use of Micro-irrigation (mcm)	24.4616
Expected Benefits	Net G.W. Availability (MCM)	25.3016
	Additional Recharge water from the water conservation structure like Tanka (MCM)	0.1296
	Total Net G.W. Availability after intervention (MCM)	25.3016
	Existing G.W Draft for all purpose (MCM)	36.2655
	Saving of Ground water through demand side intervent ion (MCM)	24.4616
	Net GW draft after interventions (MCM)	11.8039
	Present stage of G.W. development (in %)	143.8450928
	Expected stage of G.W. Development after supply side management	143.3329067
	Expected stage of G.W. Development after supply side and demand side management	46.65

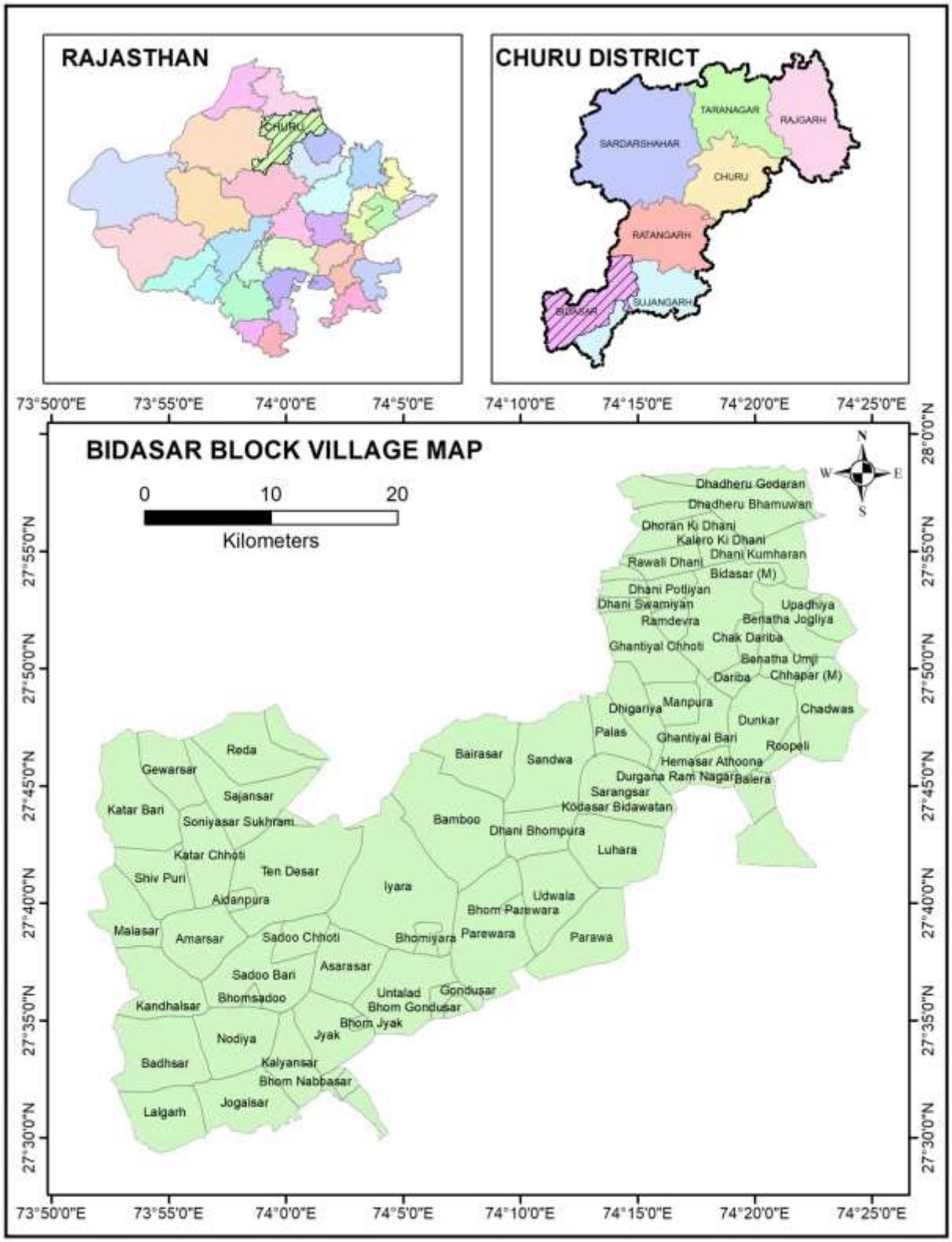


Figure. Index map of Bidasar block, Churu District.

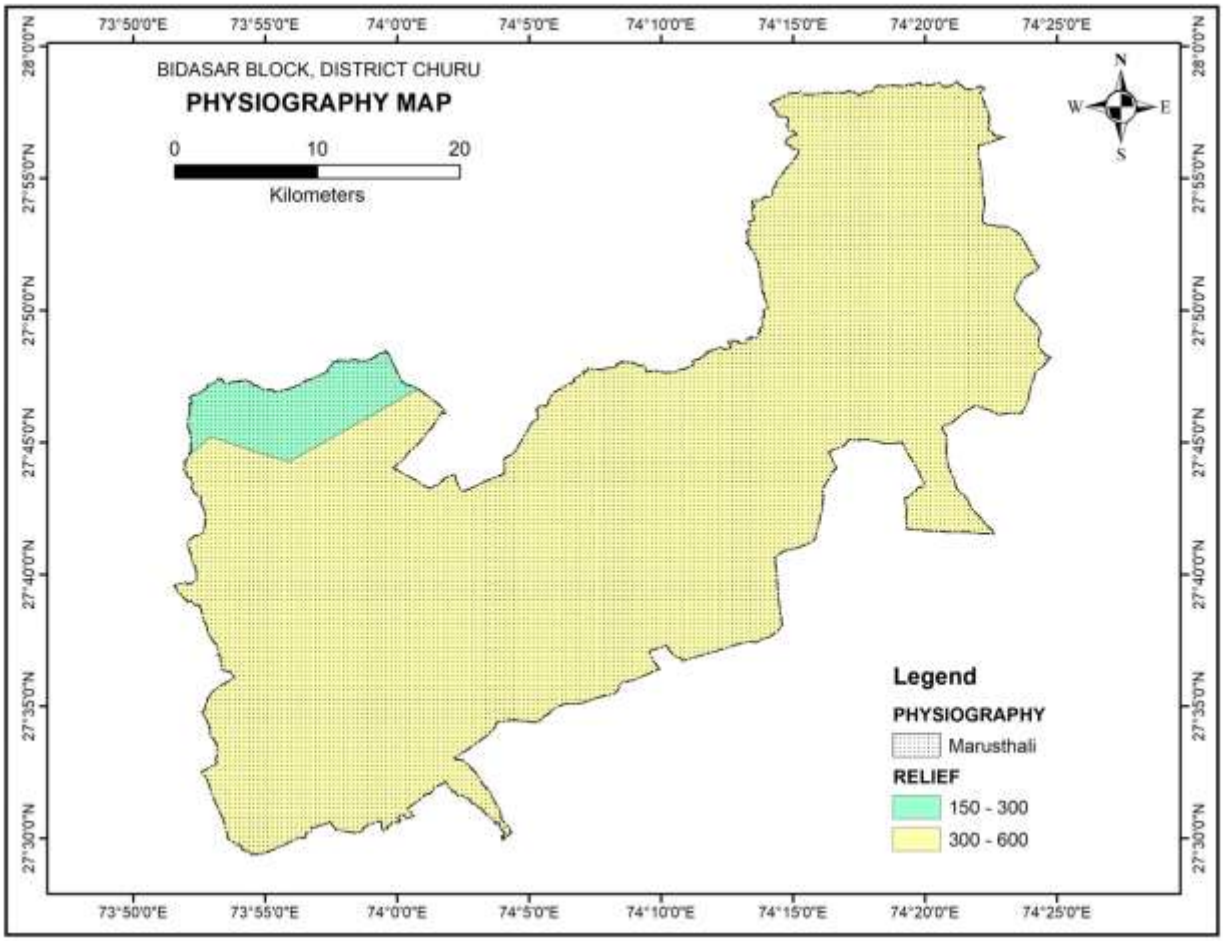


Figure. Physiography Map of Bidasar block, Churu District.

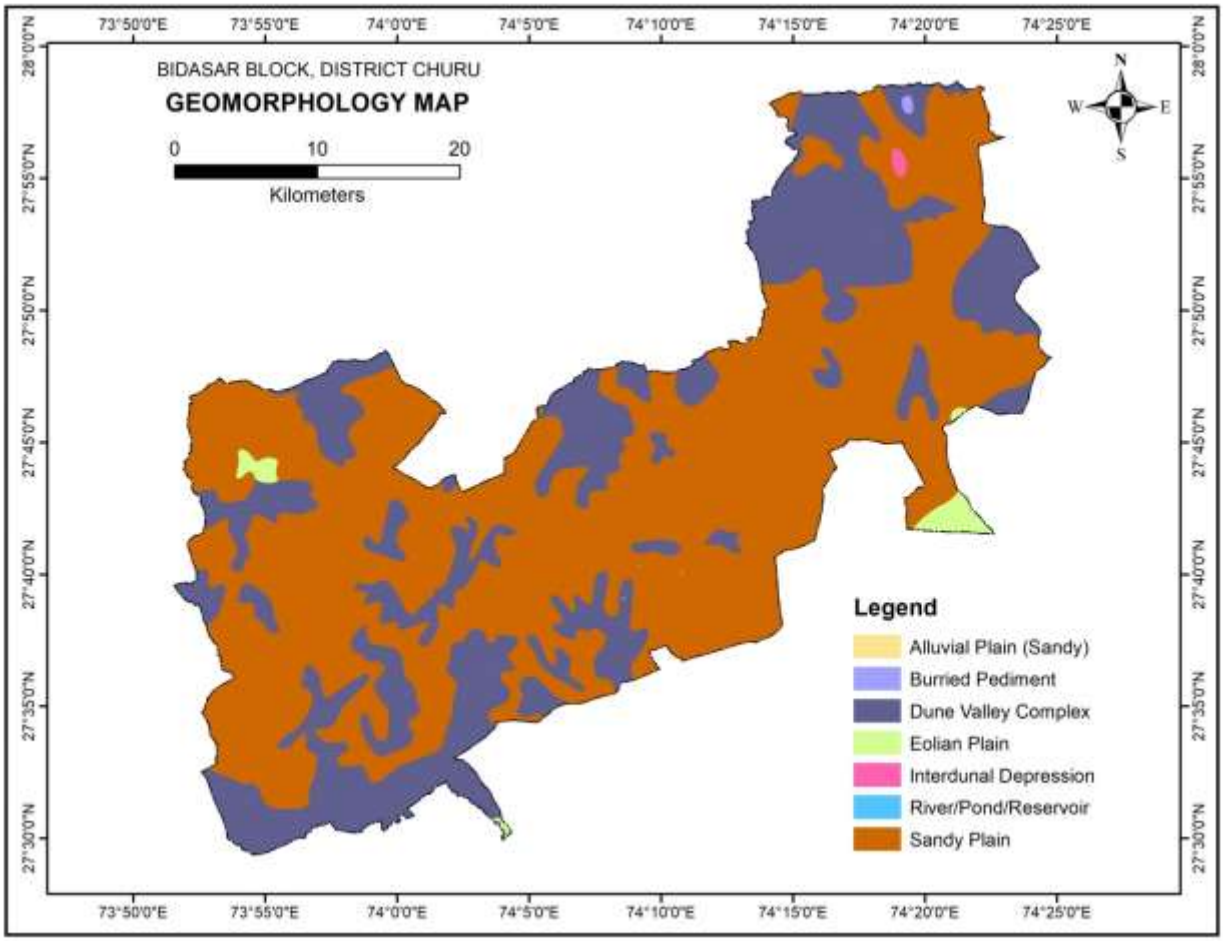


Figure. Geomorpholgy map of Bidasar block, Churu District.

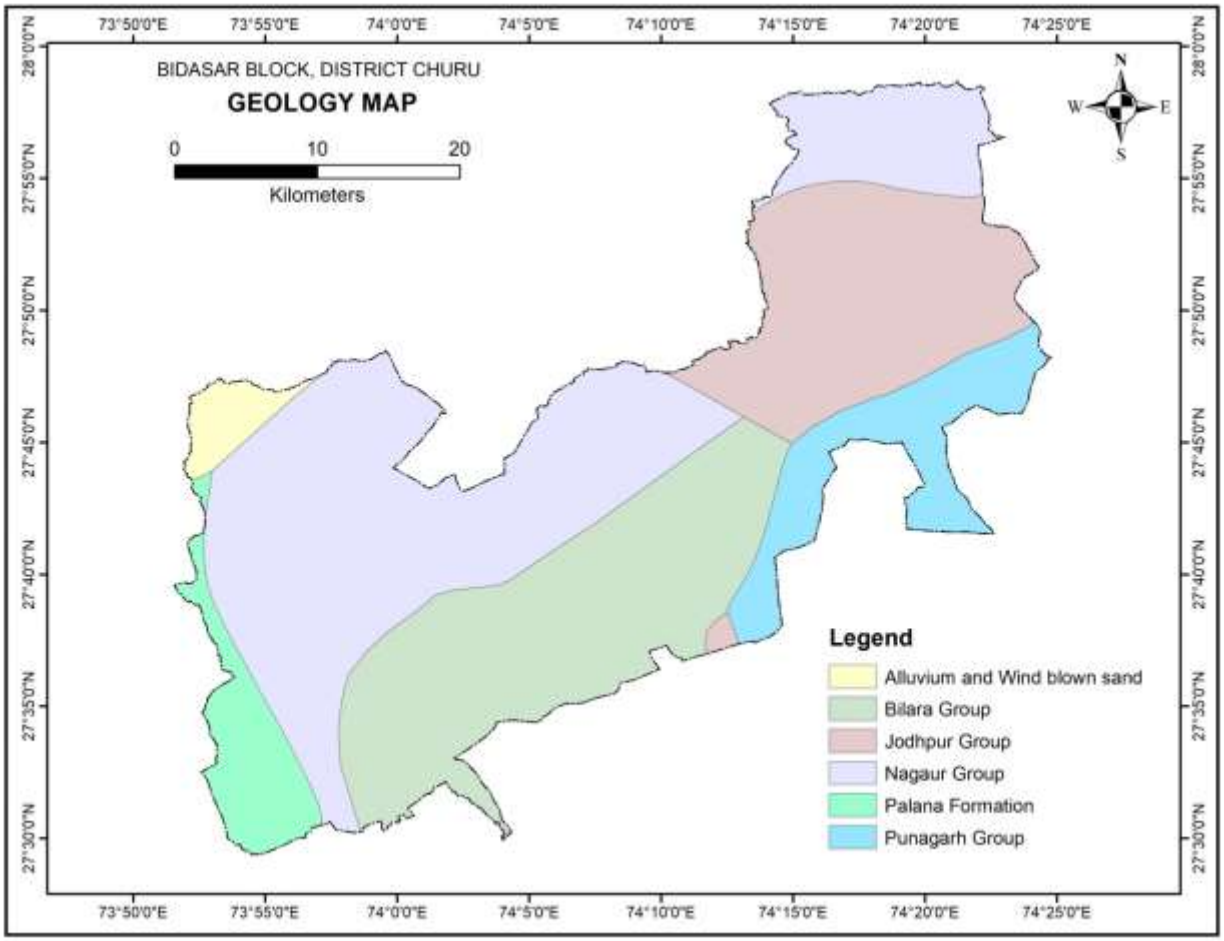


Figure. Geological map of Bidasar block, Churu District.

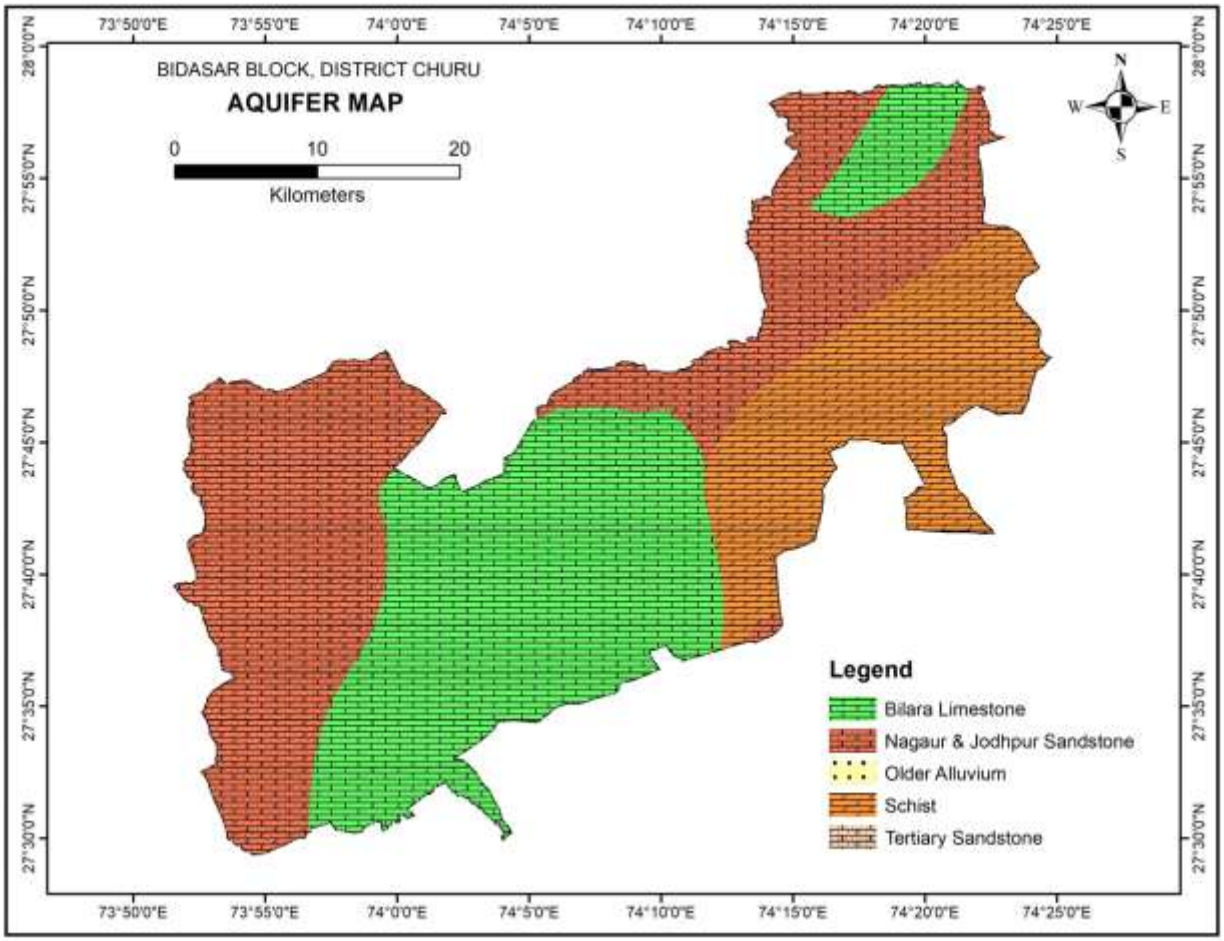


Figure. Aquifer map of Bidasar block, Churu District.

Salient Information	Block - Churu	
	Geographical Area (sq. km)	1606.87
	Forest Area (sq. km	17.87
	Potential Area (sq. Km)	484.38
Climate & Rainfall	Climate	Hot and Dry
	Average Rainfall (1990-2019)	575 mm
Aquifer System	Aquifer Characteristics	Alluvium Alluvium (saline)
	Main Aquifers in the area	Alluvium
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	0.080
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	21.20
	Trend (m/yr)	-0.18
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	3400/6240
	Chloride in mg/litre (Min/Max)	680/1361
	Nitrate in mg/litre (Min/Max)	36/104
	Fluoride in mg/litre (Min/Max)	1.32/1.92
Groundwater Resources	Total annual ground water recharge(mcm)	10.9388
	Natural discharge during non-monsoon season(mcm)	1.0939
	Net ground water availability(mcm)	9.8449
	Existing gross ground water draft for irrigation(mcm)	6.2556
	Existing gross ground water draft for domestic & industrial uses(mcm)	3.4075
	Existing gross ground water draft for all uses(mcm)	9.6631
	Allocation for domestic & industrial requirement(mcm)	3.4076
	Net ground water availability for future irrigation development(mcm)	18.17
	State of ground water development	98.15
	Category	Critical

Supply Side Management	Geographical Area of Block (Sq.km.)	1606.87
	Potential area suitable for recharge (Sq.km.)	484.38
	Thickness of unsaturated zone 3 m below ground level (m)	18.20
	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	352.63
	Tanka Structures Proposed for water conservation	3248
Demand side Management	Use of Advanced Irrigation Practices to be promoted	
	(i) Micro-irrigation	
	Total Irrigated Area (ha)	5871
	Irrigated Area (ha) proposed for micro-irrigation	2935.5
	Water Saving by Use of Micro-irrigation (mcm)	2.3484
	(ii) Change in Cropping pattern	
	Irrigated Area under wheat (ha)	2090
	Irrigated Area (ha) under wheat proposed for Gram cultivation	1045
	Water Saving by change in cropping pattern (mcm)	1.045
Expected Benefits	Net G.W. Availability (MCM)	9.8449
	Additional Recharge water from the water conservation structure like Tanka (MCM)	0.1624
	Total Net G.W. Availability after intervention (MCM)	9.8449
	Existing G.W Draft for all purpose (MCM)	9.5008
	Saving of Ground water through demand side intervent ion (MCM)	3.3934
	Net GW draft after interventions (MCM)	6.1074
	Present stage of G.W. development (in %)	98.15
	Expected stage of G.W. Development after supply side management	96.50
	Expected stage of G.W. Development after supply side and demand side management	62.04

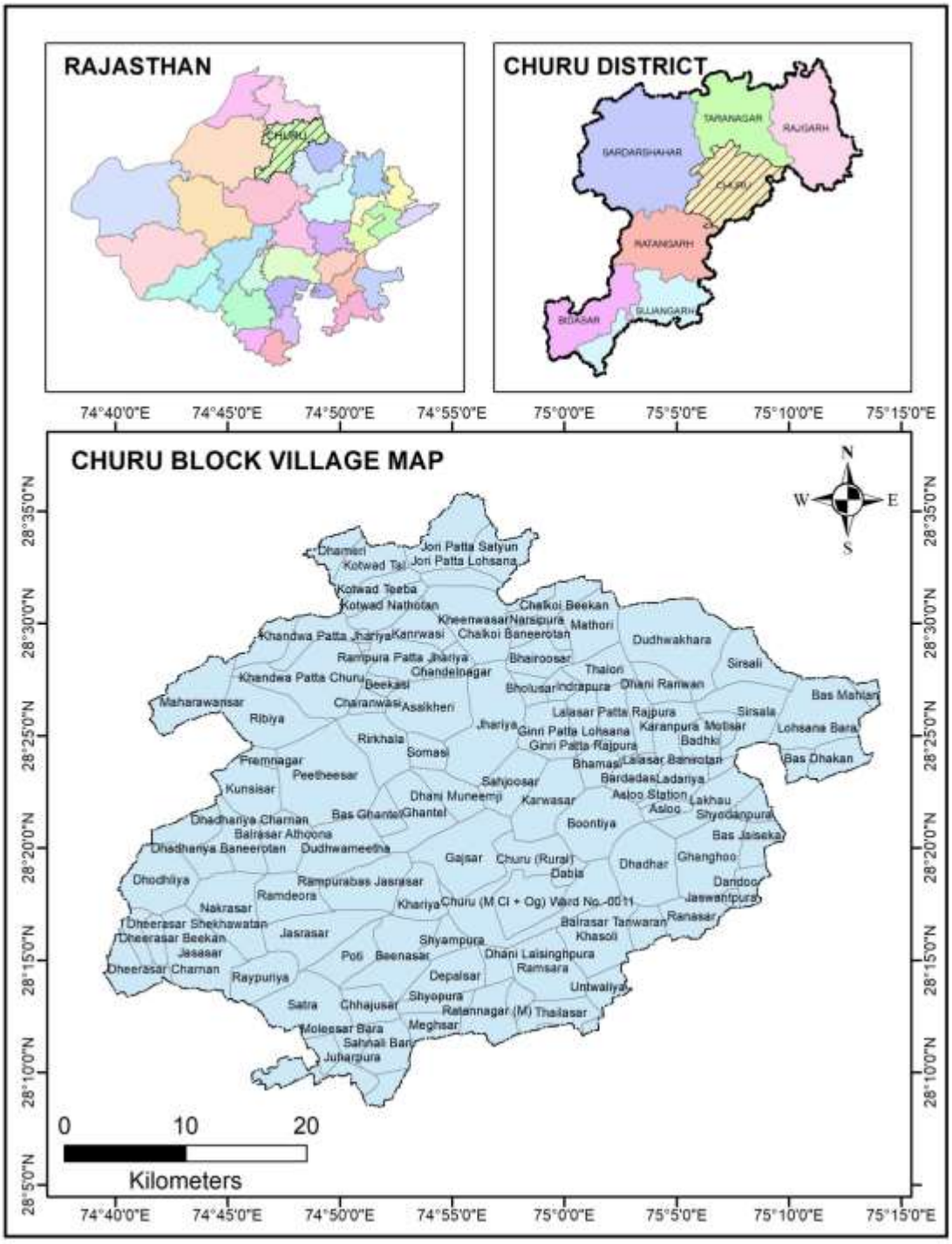


Figure. Index Map of Churu Block, Churu District.

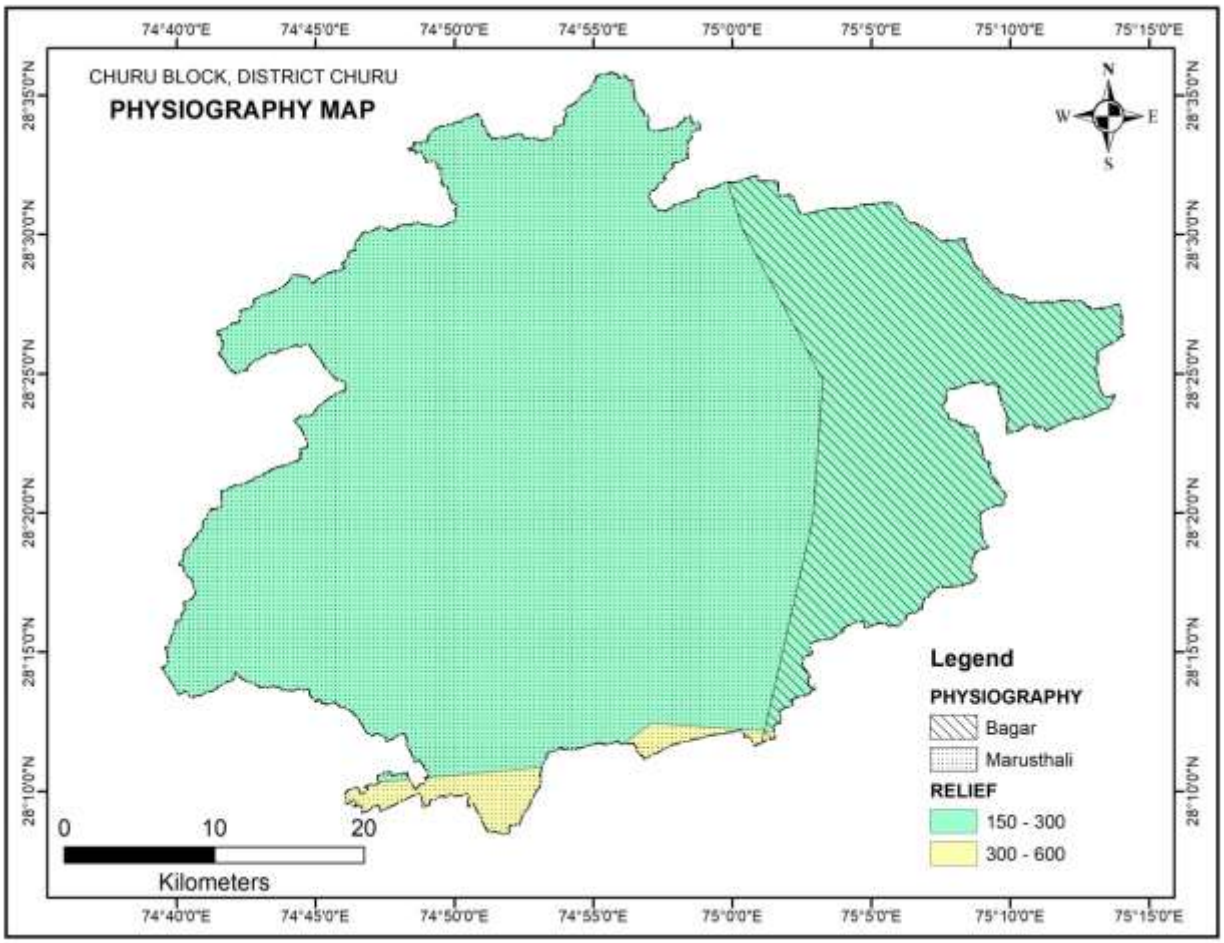


Figure. Physiography Map of Churu Block, Churu District.

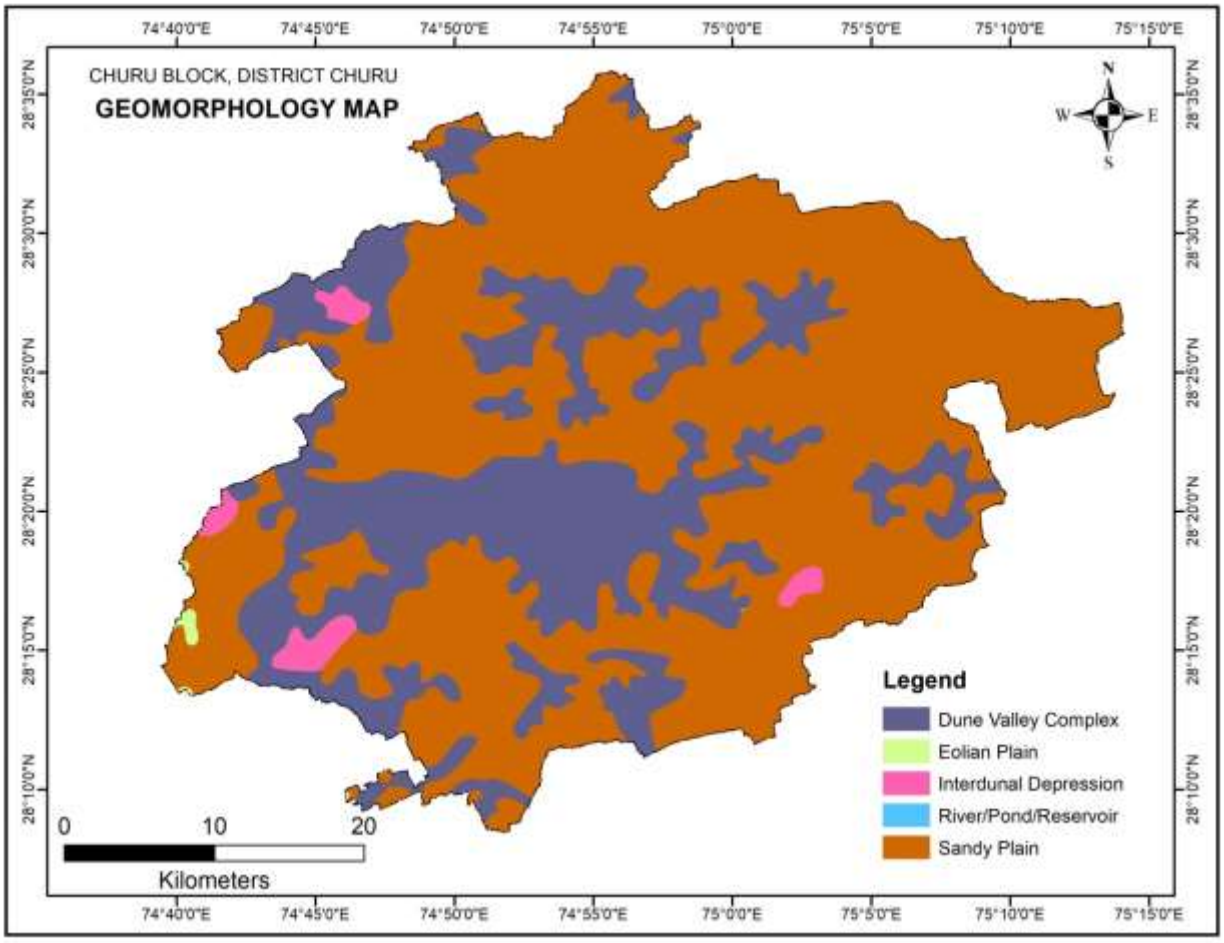


Figure. Geomorhology Map of Churu Block, Churu District.

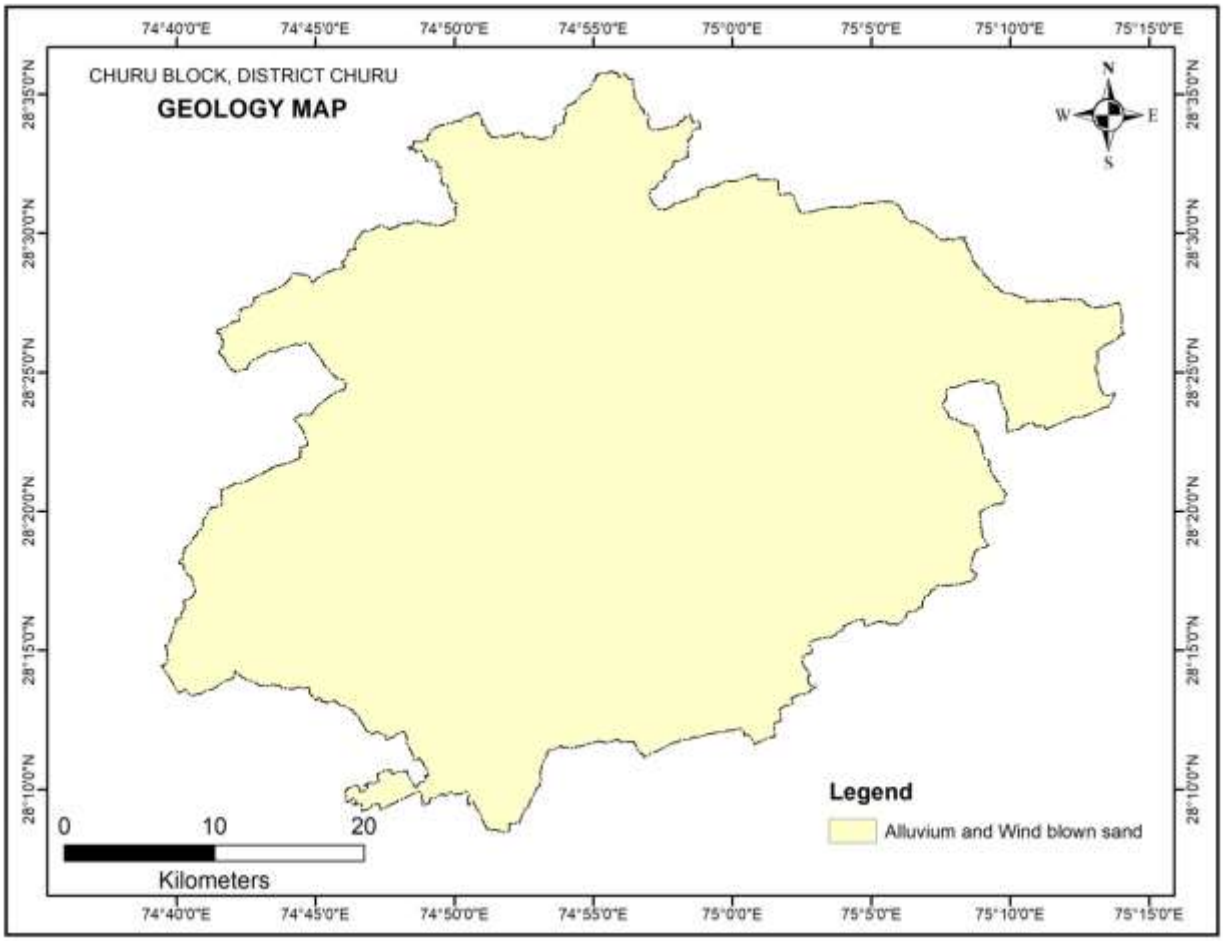


Figure. Geological Map of Churu Block, Churu District.

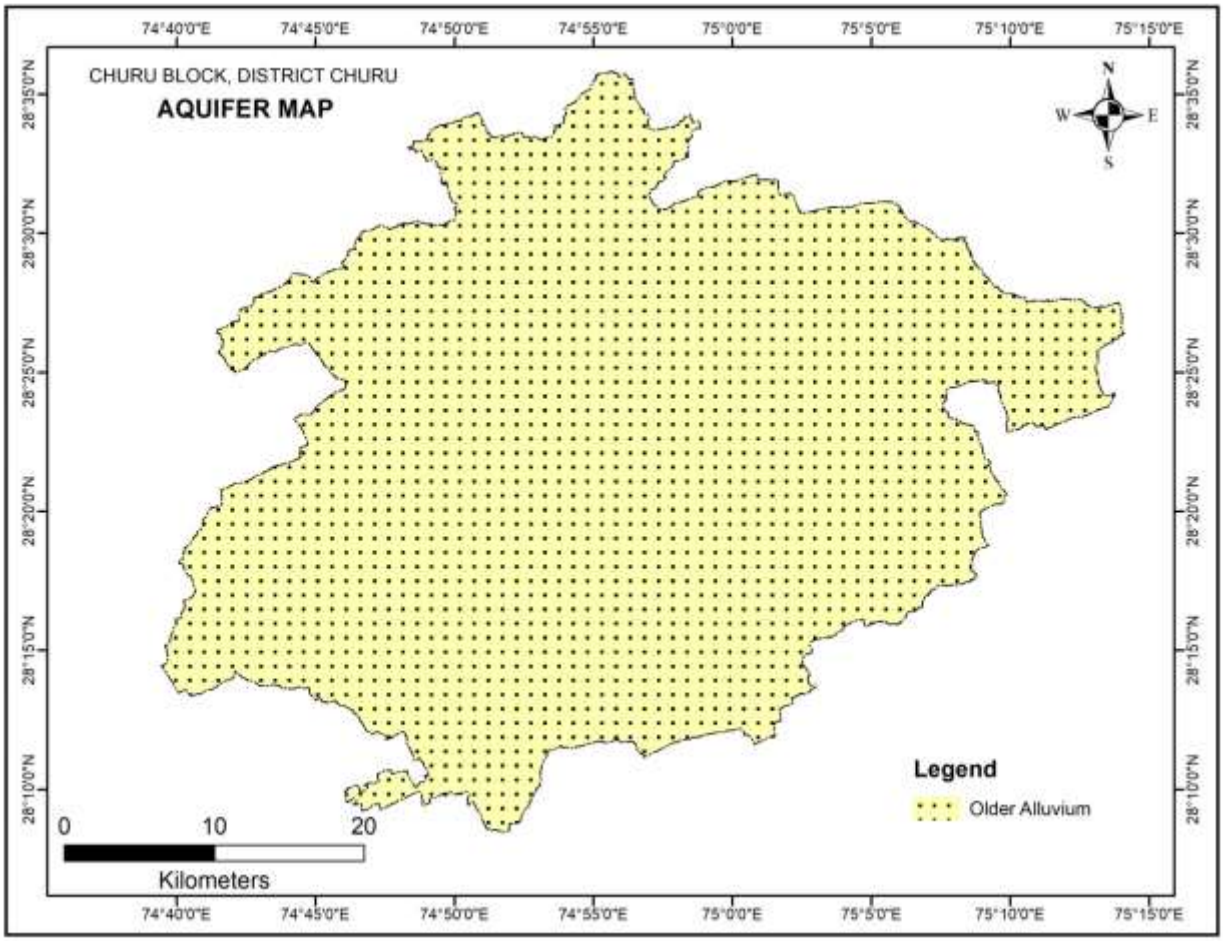


Figure. Aquifer Map of Churu Block, Churu District.

	Block - Rajgarh	
Salient Information	Geographical Area (sq. km)	2224.92
	Forest Area (sq. km)	18.66
	Potential Area (sq. Km)	324.25
Climate & Rainfall	Climate	Hot and Dry
	Average Rainfall (1990-2019)	346.0 mm
Aquifer System	Aquifer Characteristics	Alluvium Alluvium (saline)
	Main Aquifers in the area	Alluvium
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	0.080
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	11.92
	Trend (m/yr)	-0.51
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	325/8420
	Chloride in mg/litre (Min/Max)	67/2266
	Nitrate in mg/litre (Min/Max)	6.60/108
	Fluoride in mg/litre (Min/Max)	0.47/2.95
Groundwater Resources (source GWRA 2020)	Total annual ground water recharge(mcm)	11.0975
	Natural discharge during non-monsoon season(mcm)	1.1098
	Net ground water availability(mcm)	9.9877
	Existing gross ground water draft for irrigation(mcm)	26.25781
	Existing gross ground water draft for domestic & industrial uses(mcm)	4.148
	Existing gross ground water draft for all uses(mcm)	30.405812
	Allocation for domestic & industrial requirement(mcm)	4.148
	Net ground water availability for future irrigation development(mcm)	0
	State of ground water development	304.43

	Category	Over-exploited
Supply Side Management	Geographical Area of Block (Sq.km.)	2224.92
	Potential area suitable for recharge (Sq.km.)	324.25
	Area feasible for artificial recharge (Sq km)	
	Thickness of unsaturated zone 3 m below ground level (m)	8.92
	Volume of sub surface storage space available for artificial recharge (MCM)	115.69
	Surplus Runoff Availability (MCM)	0
	Tanka Structures Proposed for water conservation	5792
Demand side Management	Use of Advanced Irrigation Practices to be promoted	
	(i) Micro-irrigation	
	Total Irrigated Area (ha)	22103
	Irrigated Area (ha) proposed for micro-irrigation	11051.5
	Water Saving by Use of Micro-irrigation (mcm)	8.8412
	(ii) Change in Cropping pattern	
	Irrigated Area under wheat (ha)	4552
	Irrigated Area (ha) under wheat proposed for Gram cultivation	2276
	Water Saving by change in cropping pattern (mcm)	2.276
Expected Benefits	Net G.W. Availability (MCM)	9.9877
	Additional Recharge water from the water conservation structure Tanka (MCM)	0.2896
	Total Net G.W. Availability after intervention (MCM)	9.9877
	Existing G.W Draft for all purpose (MCM)	30.1162
	Saving of Ground water through demand side intervent ions (MCM)	11.1172
	Net GW draft after interventions (MCM)	18.9990
	Present stage of G.W. development (in %)	304.43
	Expected stage of G.W. Development after supply side management	301.5332559
	Expected stage of G.W. Development after supply side and demand side management	190.2243459

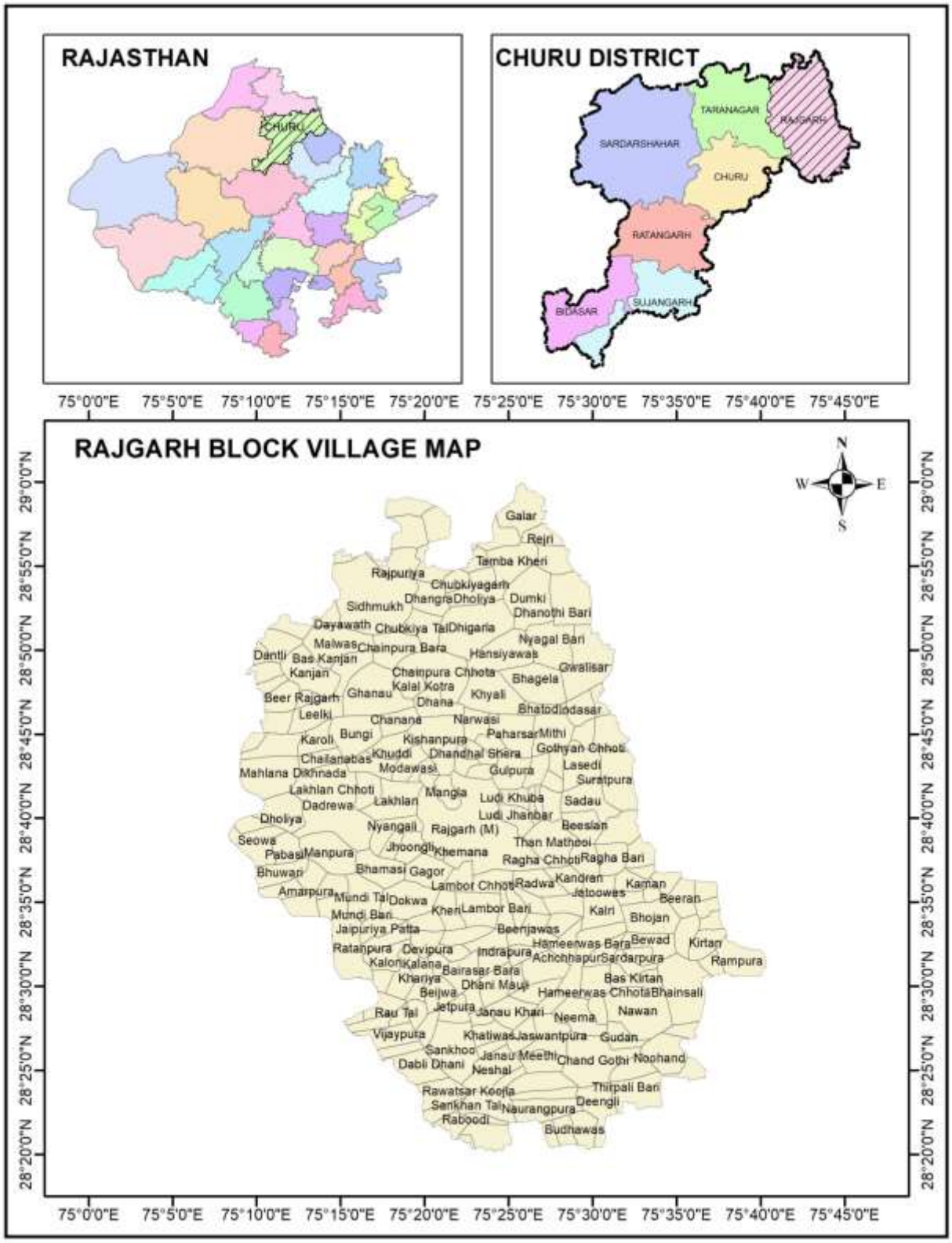


Figure. Index Map of Rajgarh Block, Churu District.

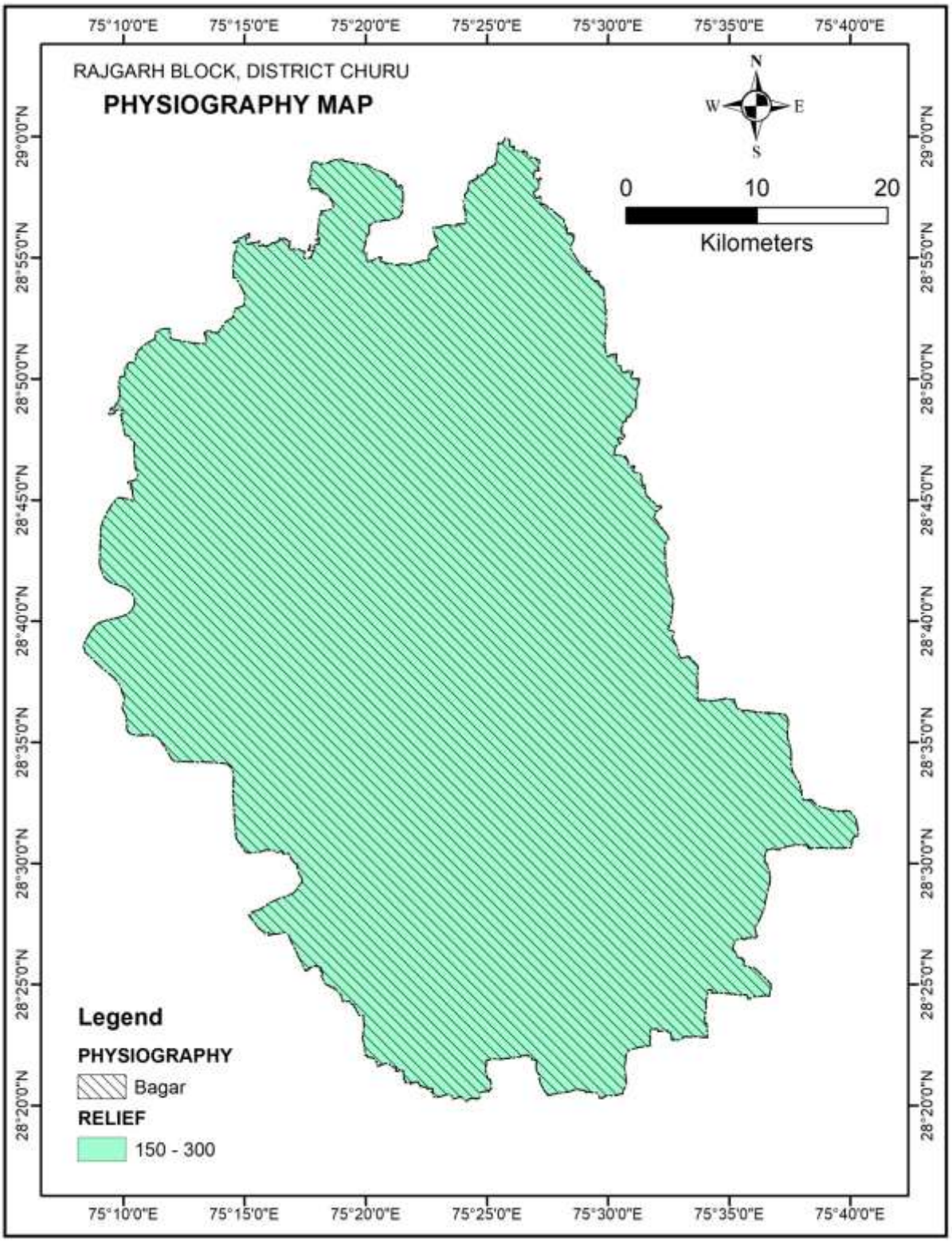


Figure. Physiography Map of Rajgarh Block, Churu District.

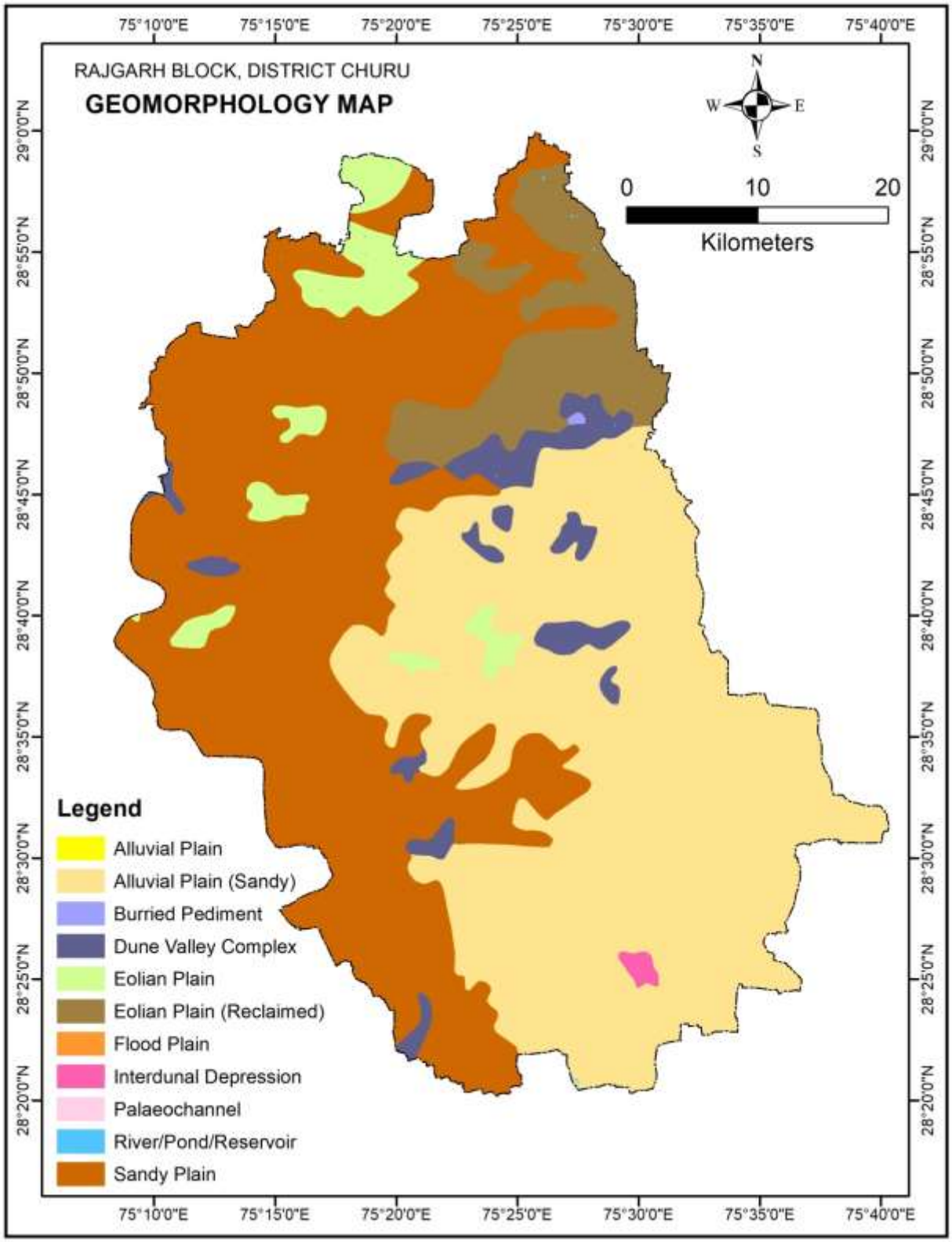


Figure. Geomorphology Map of Rajgarh Block, Churu District.

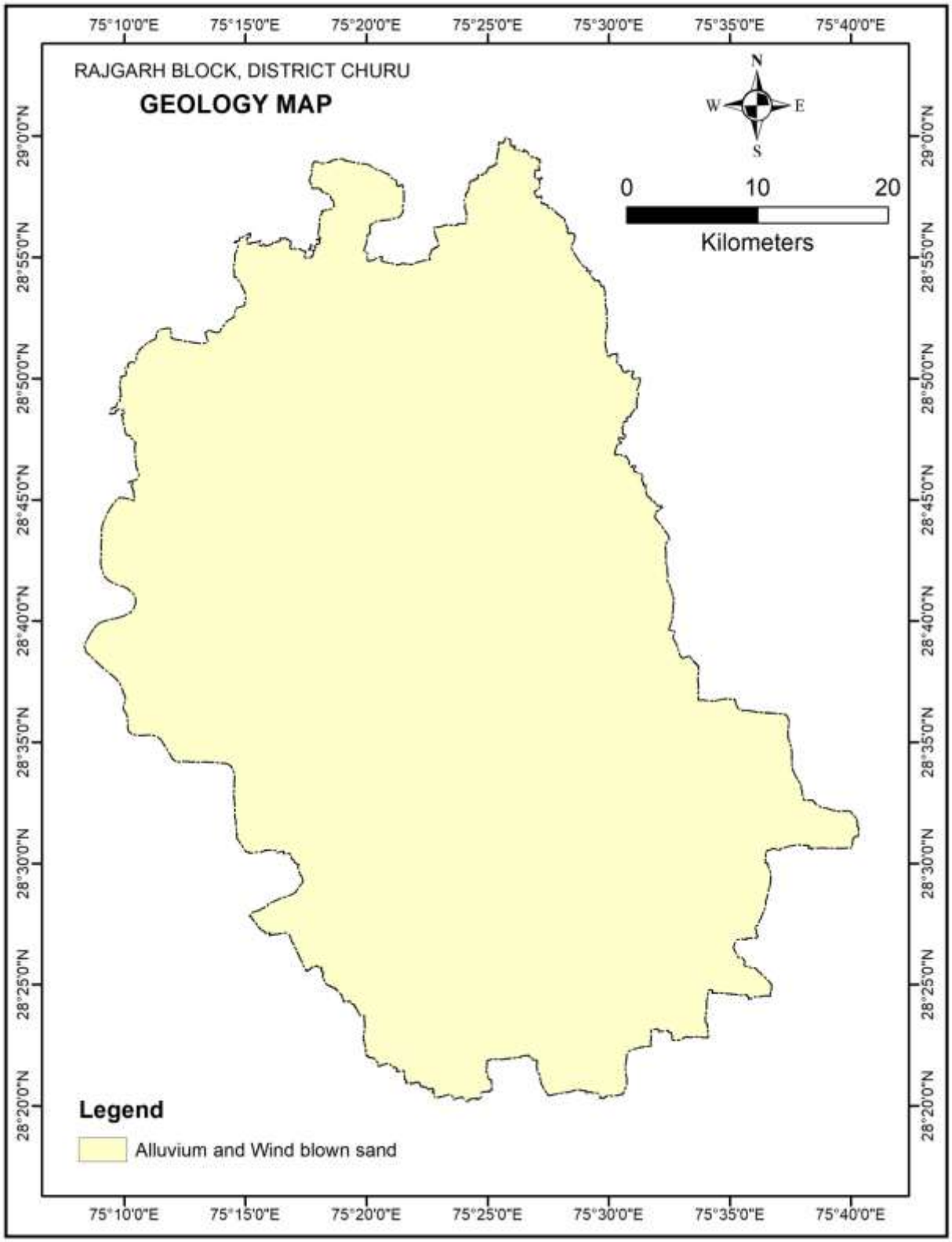


Figure. Geological Map of Rajgarh Block, Churu District.

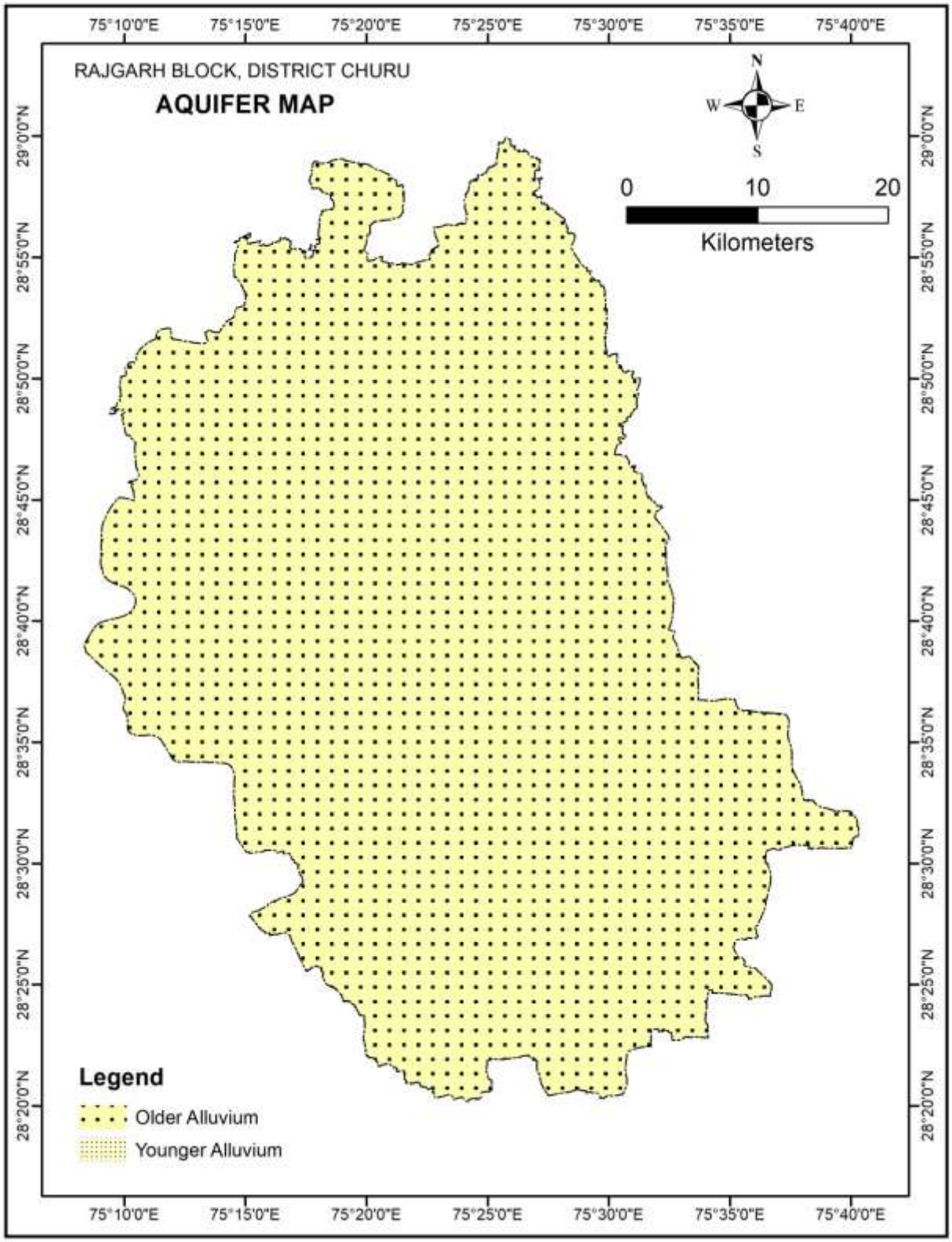


Figure. Aquifer Map of Rajgarh Block, Churu District.

Salient Information	Block - Ratangarh	
	Geographical Area (sq. km)	1622.41
	Forest Area (sq. km	2.27
	Potential Area (sq. Km)	1045.30
Climate & Rainfall	Climate	Hot and Dry Arid to Semi-arid
	Average Rainfall (1990-2019)	328 mm
Aquifer System	Aquifer Characteristics	Alluvium Sandstone
	Main Aquifers in the area	Alluvium Sandstone
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	Alluvium - 0.040 Sandstone – 0.080
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	34.23
	Trend (m/yr)	-0.23
Ground Water Quality	General	
	Electrical Conductivity in µS/cm at 25° (Min/Max)	620/5540
	Chloride in mg/litre (Min/Max)	28/440
	Nitrate in mg/litre (Min/Max)	21/1500
	Fluoride in mg/litre (Min/Max)	0.57/13.80
Groundwater Resources (Source – GWRA 2020)	Total annual ground water recharge(mcm)	23.3687
	Natural discharge during non-monsoon season(mcm)	2.3369
	Net ground water availability(mcm)	21.0318
	Existing gross ground water draft for irrigation(mcm)	16.578
	Existing gross ground water draft for domestic & industrial uses(mcm)	5.3939
	Existing gross ground water draft for all uses(mcm)	21.9719
	Allocation for domestic & industrial requirement(mcm)	5.3939

	Net ground water availability for future irrigation development(mcm)	0
	State of ground water development (in %)	104.47
	Category	Over-exploited
Supply Side Management	Geographical Area of Block (Sq.km.)	1622.41
	Potential area suitable for recharge (Sq.km.)	1045.30
	Thickness of unsaturated zone 3 m below ground level (m)	Alluvium - 31.23 Sandstone - 31.23
	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	988.56
	Tanka Structures Proposed for water conservation	3242
Demand side Management	Use of Advanced Irrigation Practices to be promoted	
	(i) Micro-irrigation (Through Sprinklers)	
	Total Irrigated Area (ha)	39225
	Irrigated Area (ha) proposed for micro-irrigation	9806.25
	Water Saving by Use of Micro-irrigation (mcm)	7.845
	(ii) Change in Cropping pattern	No Crop Pattern Change Suggested because, Micro-Irrigation suffice for aquifer management
Expected Benefits	Net G.W. Availability (MCM)	21.0318
	Additional Recharge water from the water conservation structure like Tanka (MCM)	0.1621
	Total Net G.W. Availability after intervention (MCM)	21.0318
	Existing G.W Draft for all purpose (MCM)	21.8099
	Saving of Ground water through demand side intervent ion (MCM)	7.845
	Net GW draft after interventions (MCM)	13.9649
	Present stage of G.W. development (in %)	104.47
	Expected stage of G.W. Development after supply side management (in %)	103.70
	Expected stage of G.W. Development after supply side and demand side management (in %)	66.40

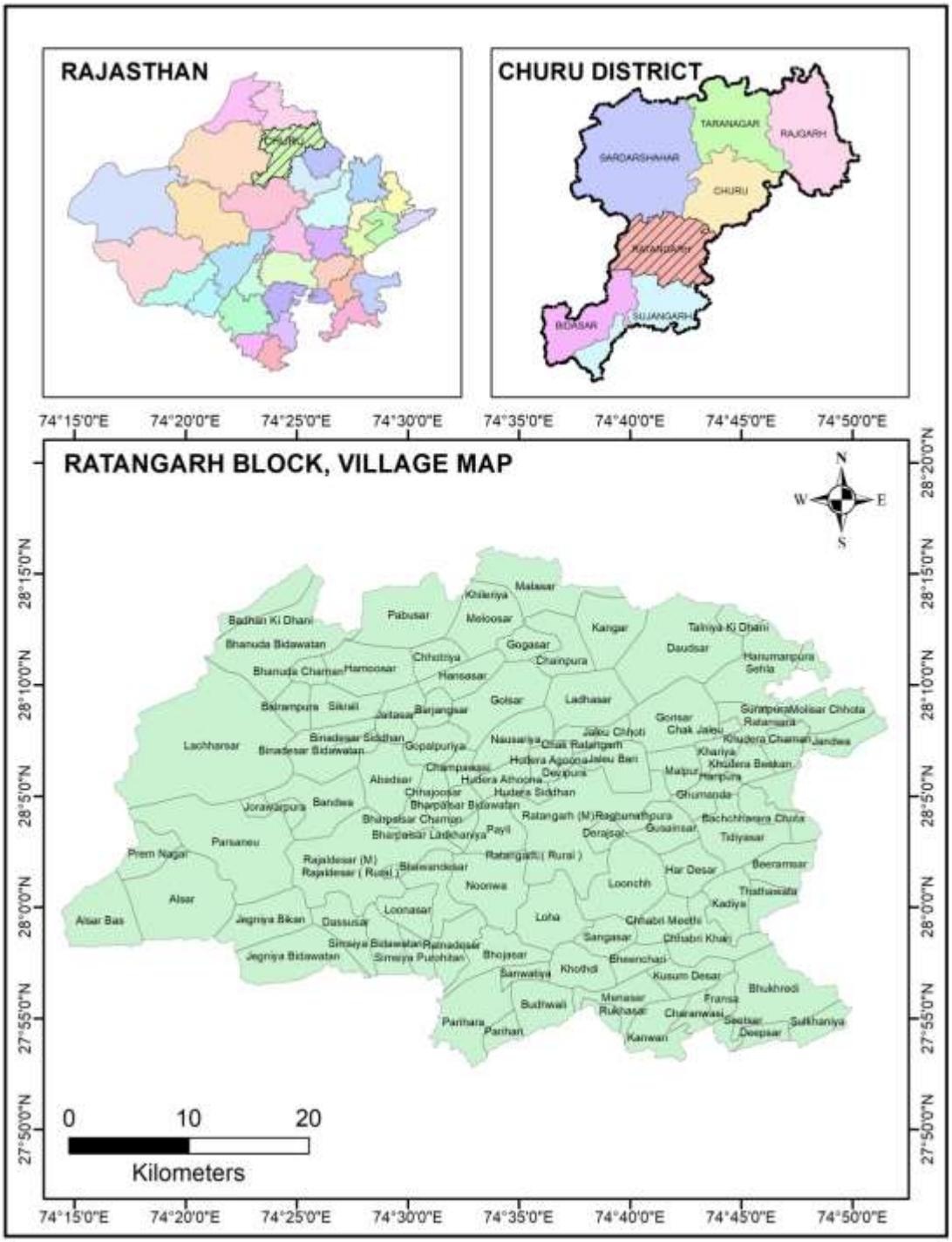


Figure. Index Map of Ratangarh Block, Churu District.

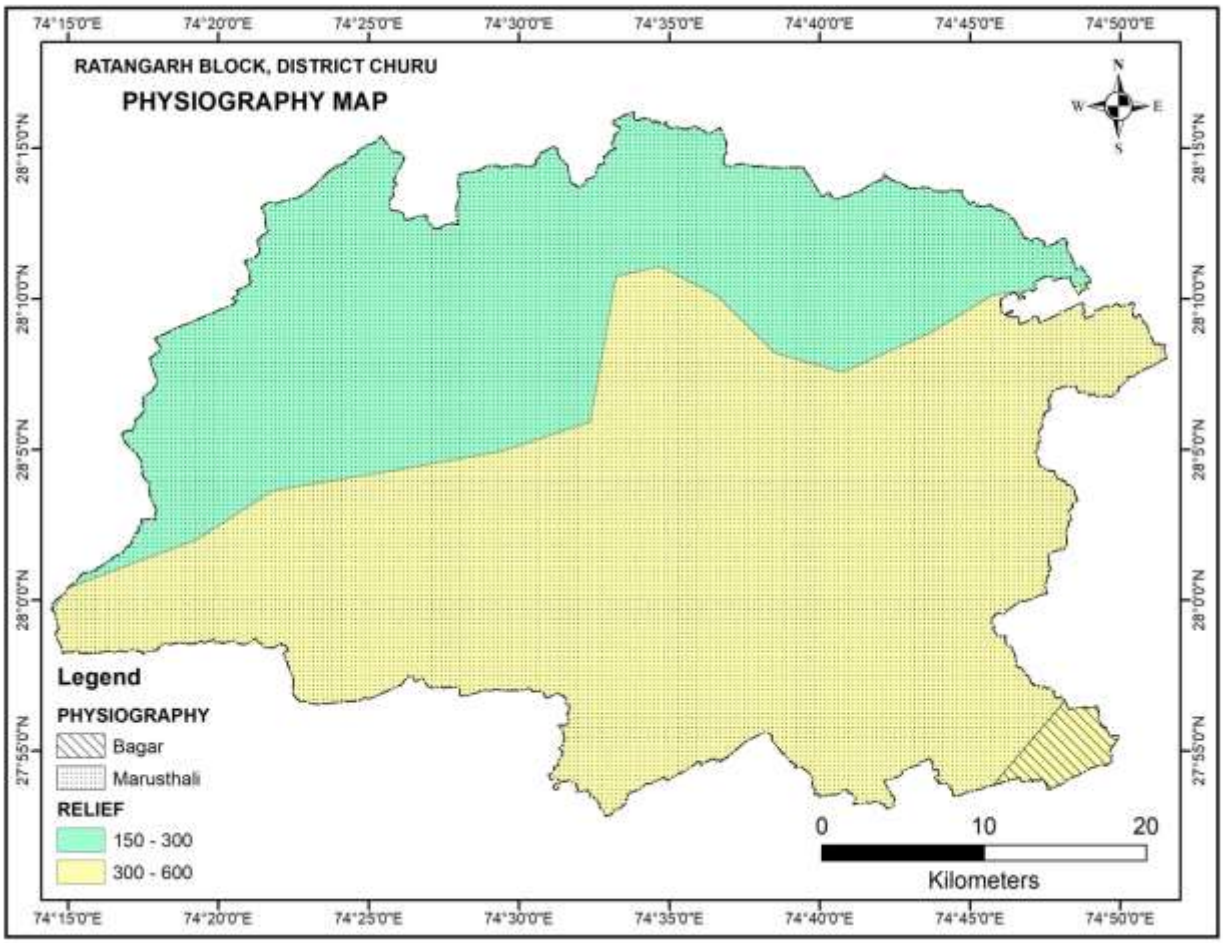


Figure. Physiography Map of Ratangarh Block, Churu District.

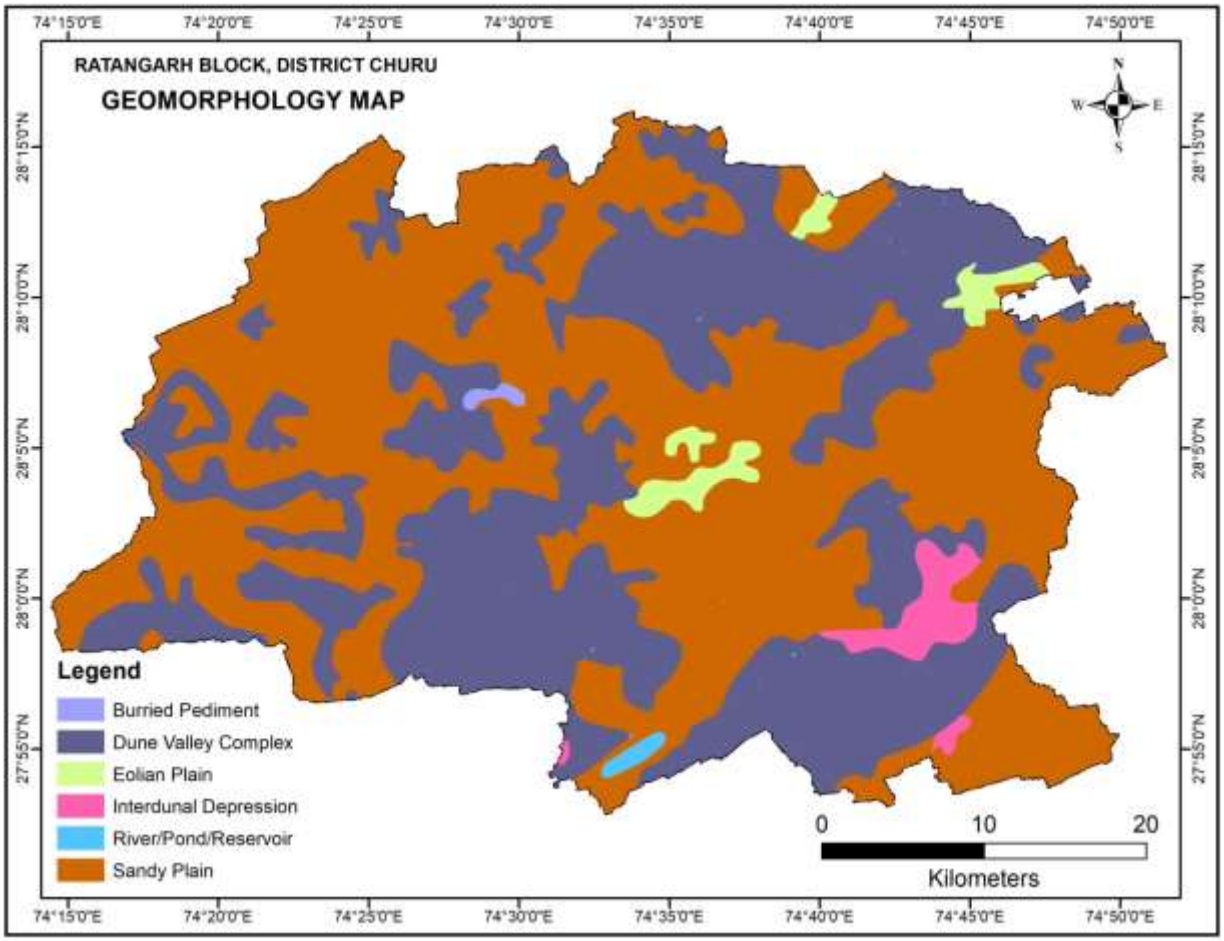


Figure. Geomorphology Map of Ratangarh Block, Churu District.

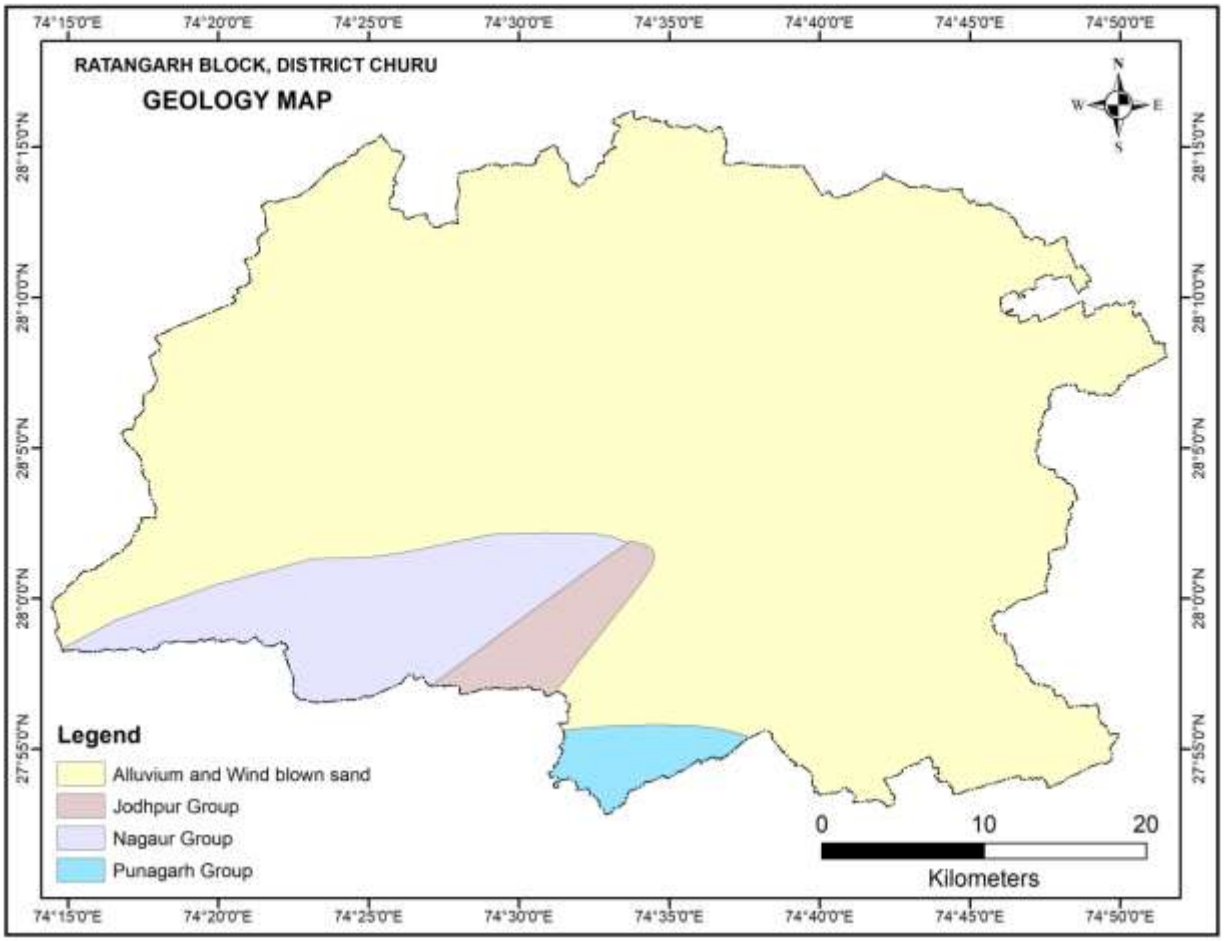


Figure. Geological Map of Ratangarh Block, Churu District.

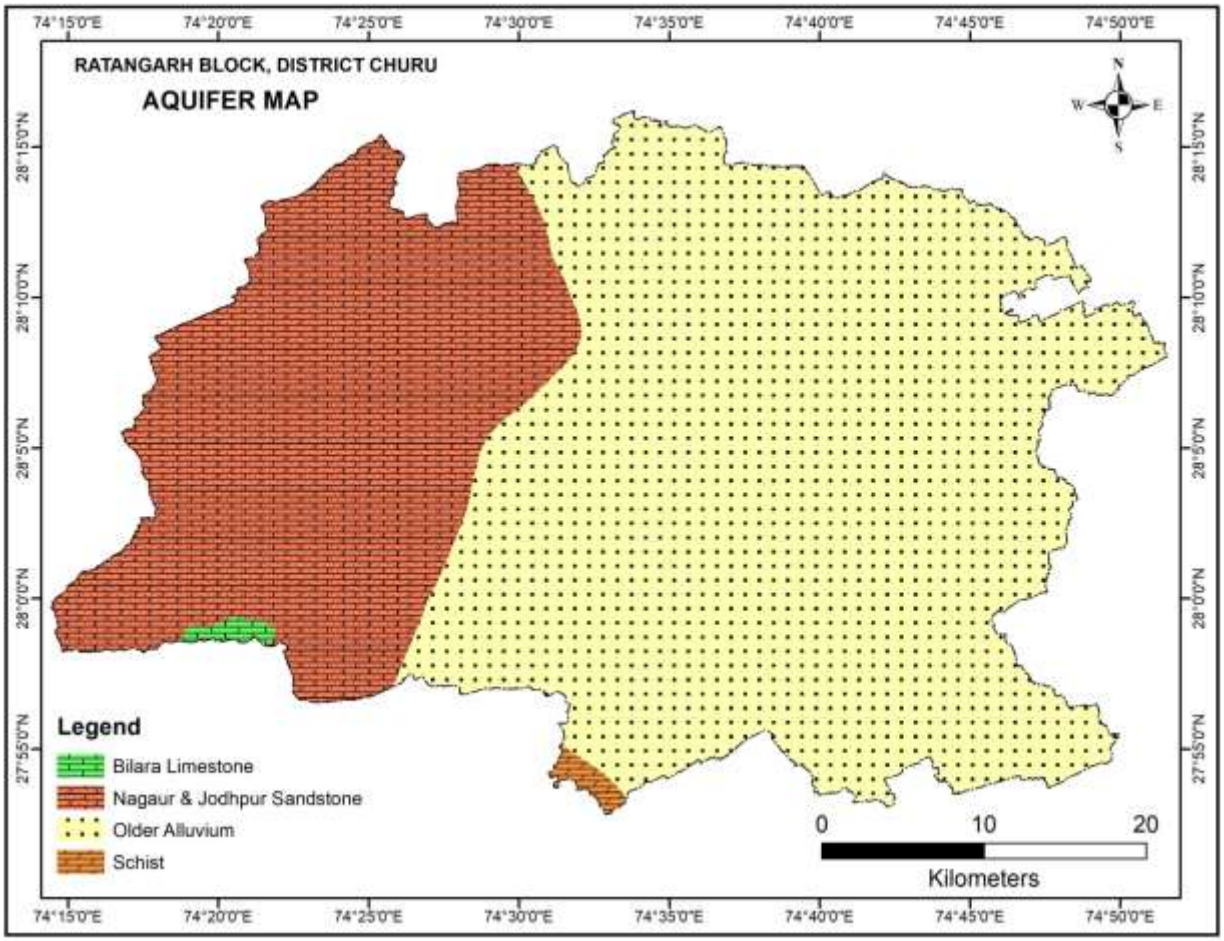


Figure. Aquifer Map of Ratangarh Block, Churu District.

Salient Information	Block - Sardarshahar	
	Geographical Area (sq. km)	3860.8
	Forest Area (sq. km	5.49
	Potential Area (sq. Km)	2123.76
Climate & Rainfall	Climate	Hot and Dry Arid Climate
	Average Rainfall (1990-2019)	258 mm
Aquifer System	Aquifer Characteristics	Alluvium Sandstone
	Main Aquifers in the area	Alluvium Sandstone
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	Alluvium – 0.040 Sandstone – 0.080
Water Level Behavior DTW (m)	Depth to Water Level (m BGL)	Alluvium – 39.02 Sandstone – 43.16
	Trend (m/yr)	-0.50
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	320/8980
	Chloride in mg/litre (Min/Max)	53/2137
	Nitrate in mg/litre (Min/Max)	7.66/70
	Fluoride in mg/litre (Min/Max)	0.18/1.65
Groundwater Resources	Total annual ground water recharge(mcm)	48.572
	Natural discharge during non-monsoon season(mcm)	4.8572
	Net ground water availability(mcm)	43.7148
	Existing gross ground water draft for irrigation(mcm)	17.64
	Existing gross ground water draft for domestic & industrial uses(mcm)	8.2599
	Existing gross ground water draft for all uses(mcm)	25.8999
	Allocation for domestic & industrial requirement(mcm)	8.26
	Net ground water availability for future irrigation development(mcm)	17.815
	State of ground water development (in %)	59.25
	Category	Safe

Supply Side Management	Geographical Area of Block (Sq.km.)	3860.8
	Potential area suitable for recharge (Sq.km.)	2123.76
	Area feasible for artificial recharge (Sq km)	-
	Thickness of unsaturated zone 3 m below ground level (m)	Alluvium – 36.02 Sandstone – 40.16
	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	1787.74
	Tanka Structures Proposed for water conservation	4840
Demand side Management	No Demand side interventions are required because the blocks is under Safe Category	
Expected Benefits	Net G.W. Availability (MCM)	48.572
	Additional Recharge water from the water conservation structure like Tanka (MCM)	0.2420
	Total Net G.W. Availability after intervention (MCM)	48.572
	Existing G.W Draft for all purpose (MCM)	25.6580
	Present stage of G.W. development (in %)	59.25
	Expected stage of G.W. Development after supply side management (in %)	58.69

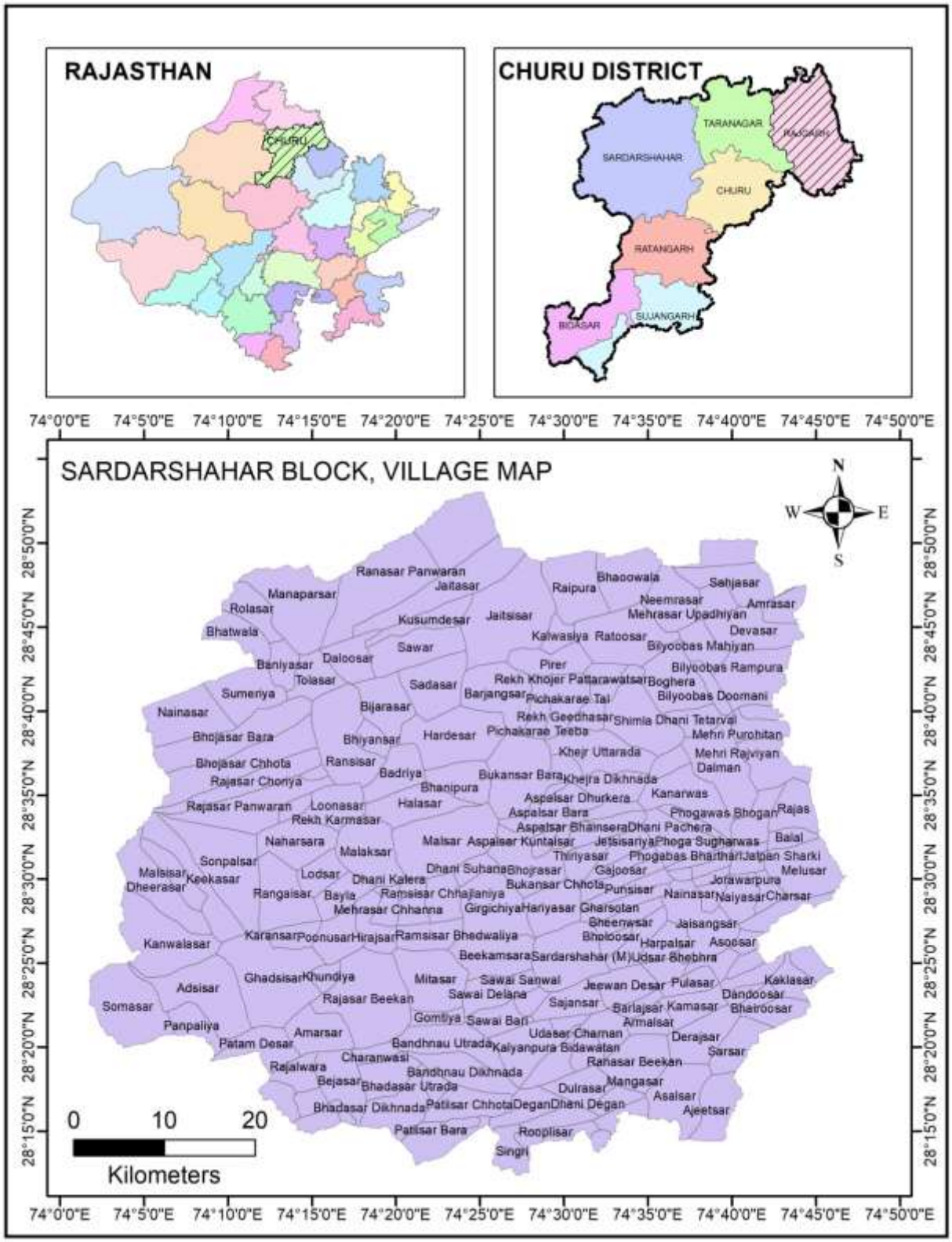


Figure. Index Map of Sardarshahar Block, Churu District.

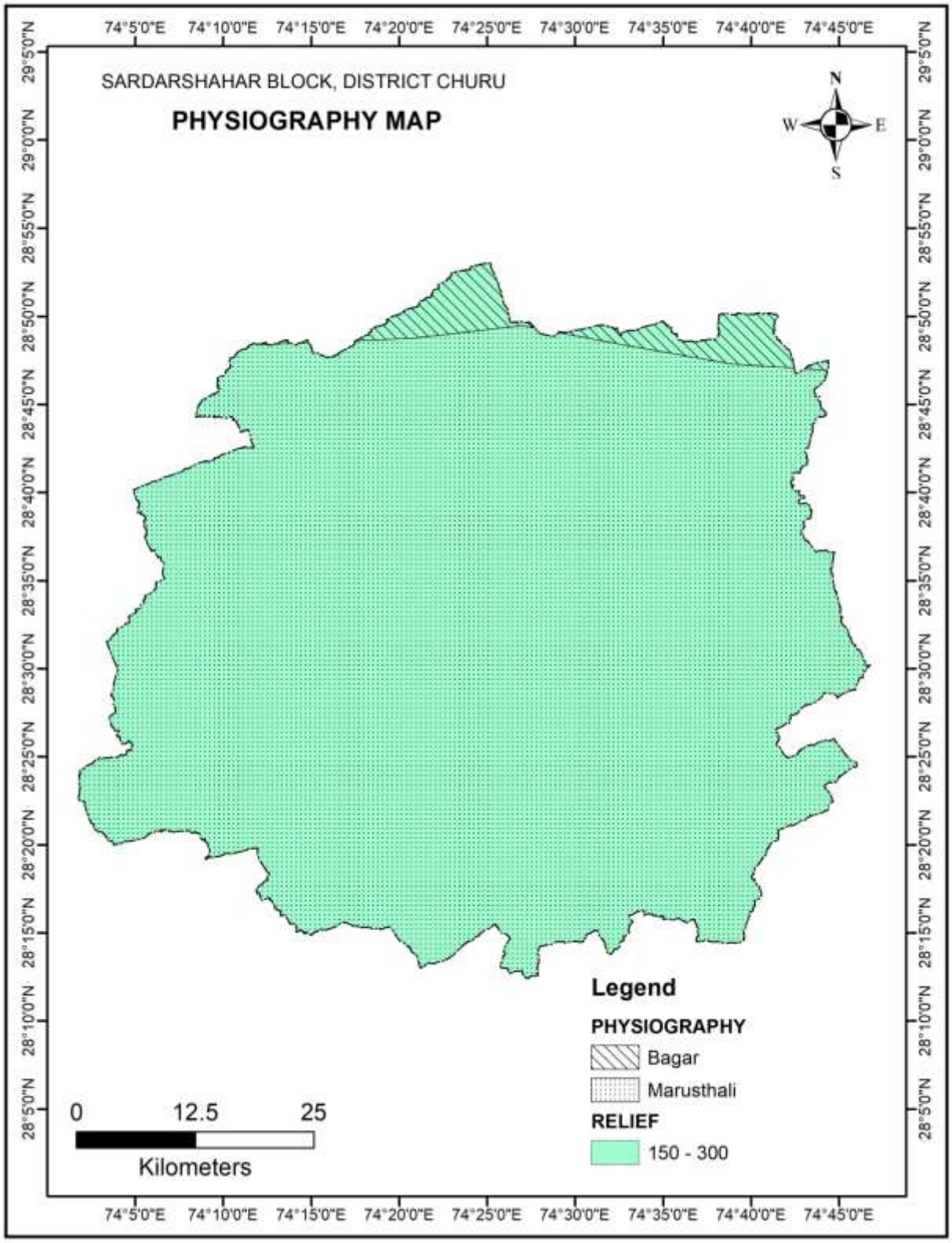


Figure. Physiography Map of Sardarshahar Block, Churu District.

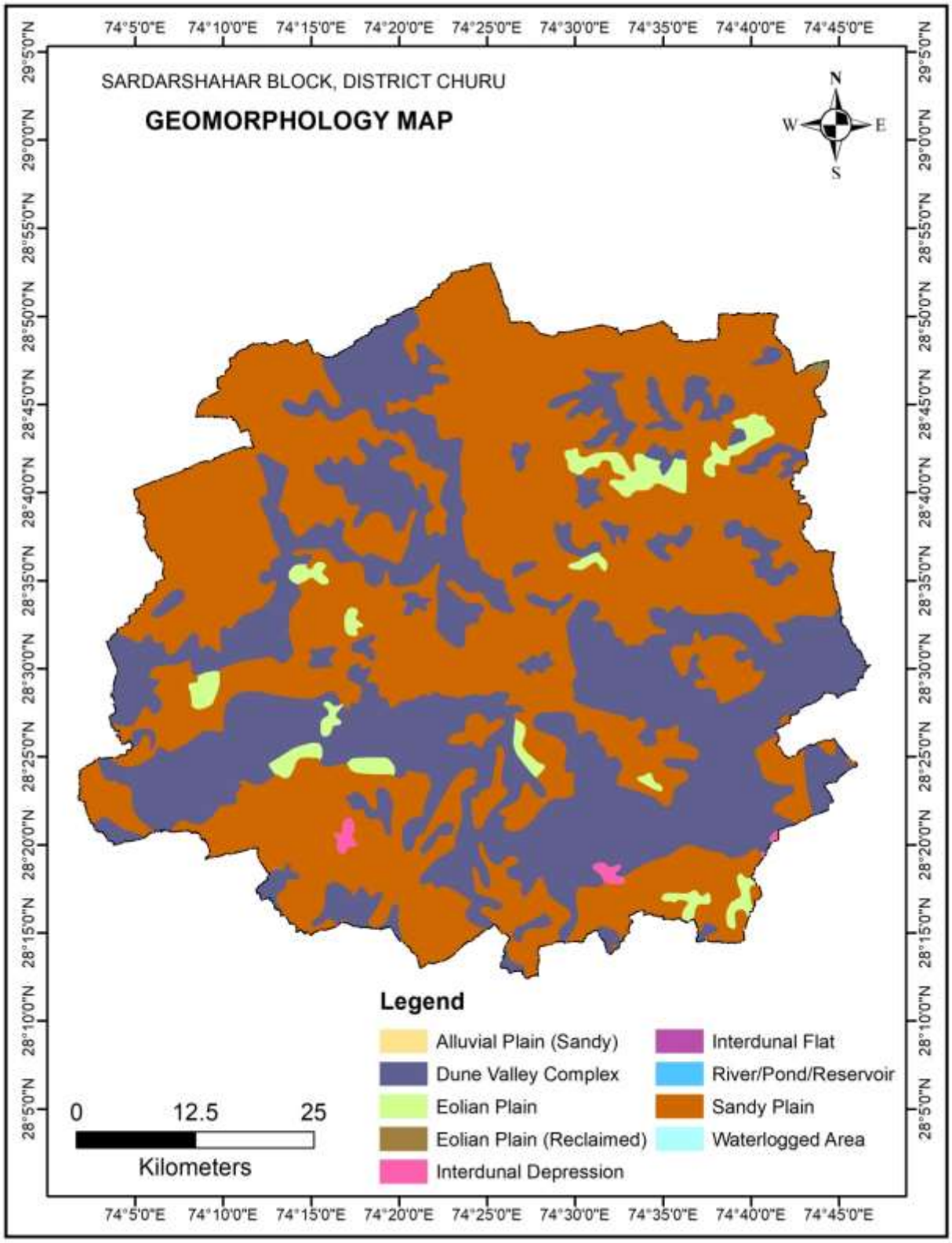


Figure . Geomorphology Map of Sardarshahar Block, Churu District.

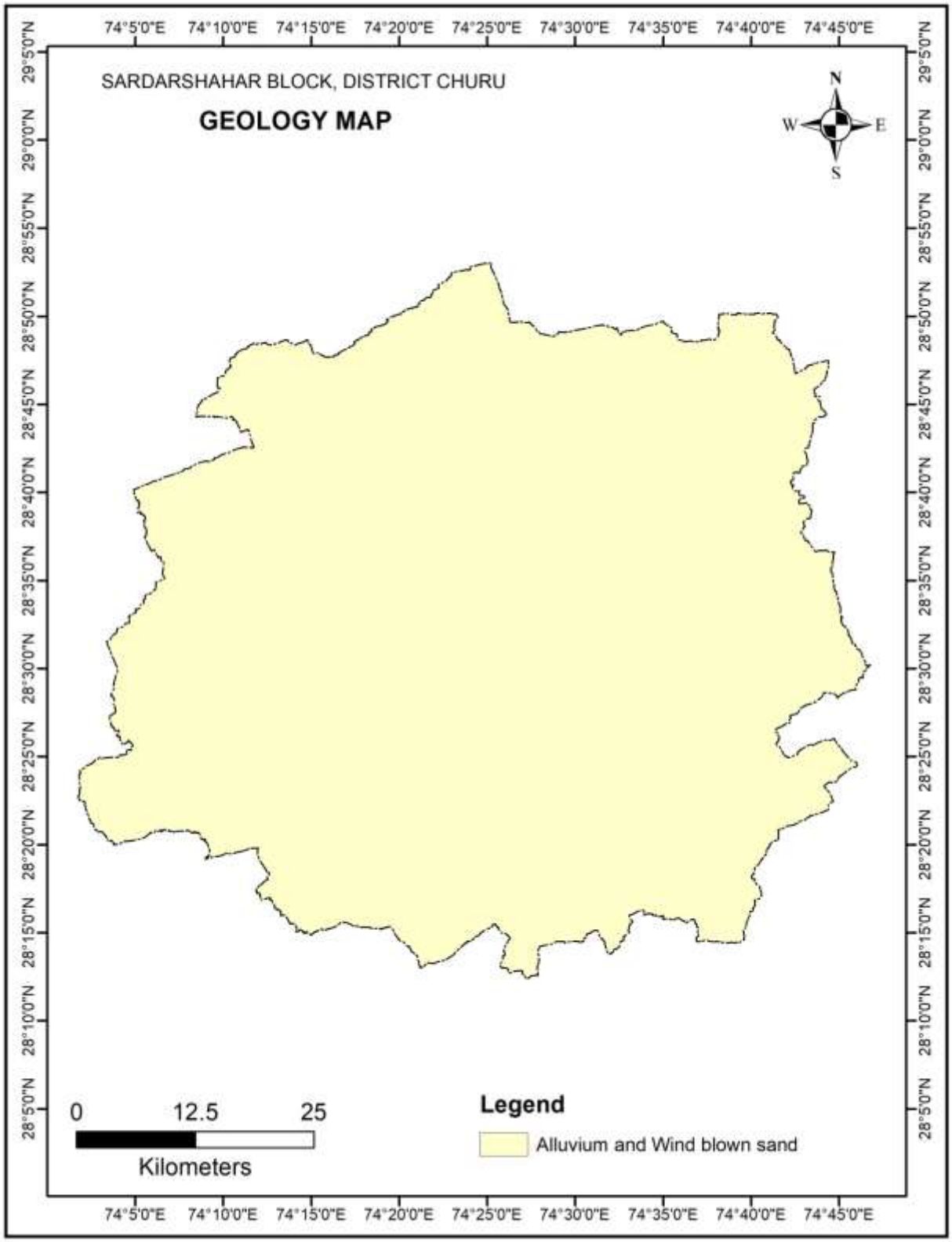


Figure. Geological Map of Sardarshahar Block, Churu District.

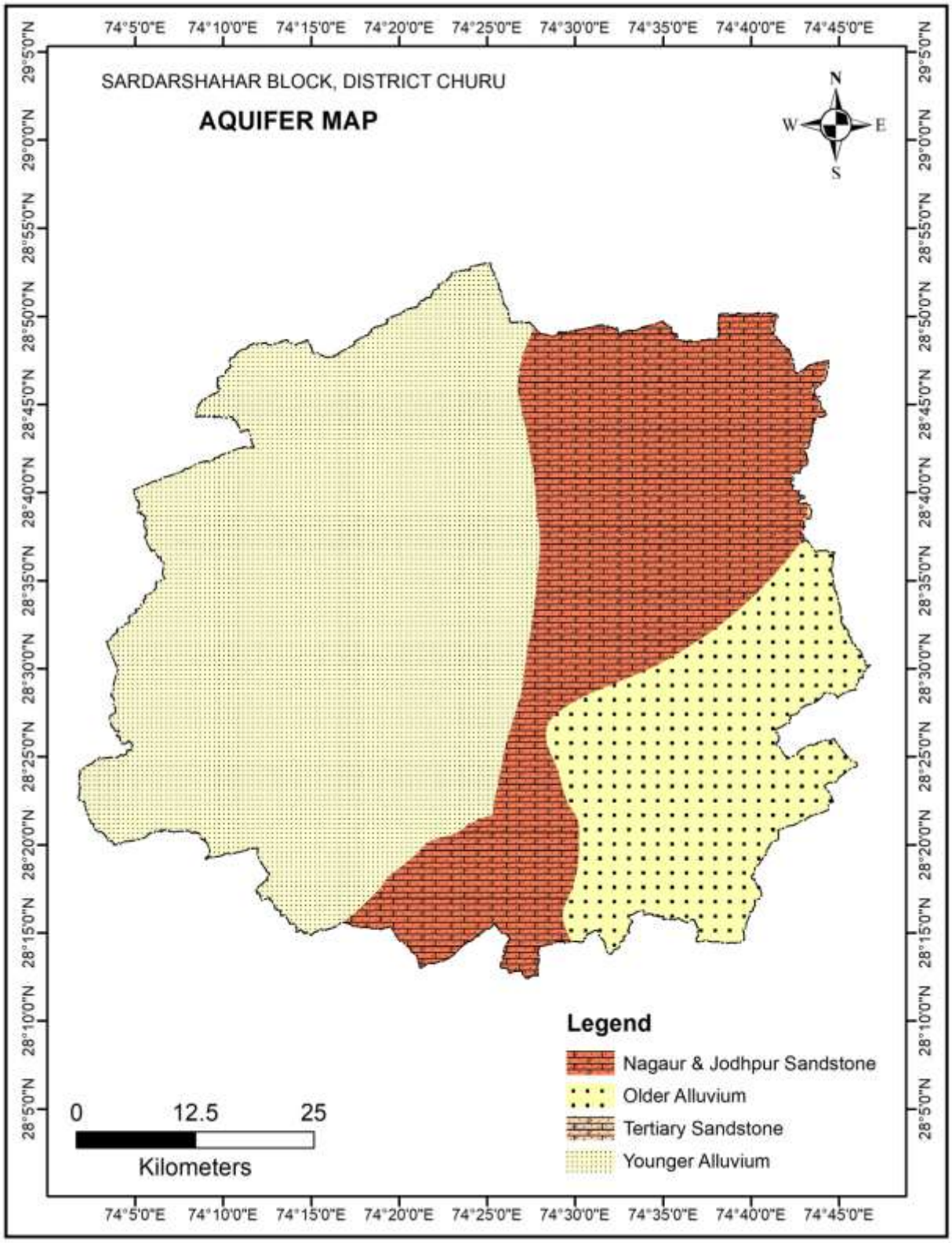


Figure. Aquifer Map of Sardarshahar Block, Churu District.

Salient Information	Block - Sujangarh	
	Geographical Area (sq. km)	1528.83
	Forest Area (sq. km	12.11
	Potential Area (sq. Km)	484.38
Climate & Rainfall	Climate	Hot and Dry Arid Climate
	Average Rainfall (1990-2019)	407 mm
Aquifer System	Aquifer Characteristics	Limestone Sandstone
	Main Aquifers in the area	Limestone Sandstone
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	Limestone - 0.040 Sandstone – 0.080
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	9.68
	Trend (m/yr)	0.50
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1190/17000
	Chloride in mg/litre (Min/Max)	128/4112
	Nitrate in mg/litre (Min/Max)	18/1800
	Fluoride in mg/litre (Min/Max)	0.10/17.60
Groundwater Resources (sources – GWRA 2020)	Total annual ground water recharge(mcm)	6.9249
	Natural discharge during non-monsoon season(mcm)	.6925
	Net ground water availability(mcm)	6.2324
	Existing gross ground water draft for irrigation(mcm)	8.1114
	Existing gross ground water draft for domestic & industrial uses(mcm)	1.6542
	Existing gross ground water draft for all uses(mcm)	9.7656
	Allocation for domestic & industrial requirement(mcm)	1.6542

	Net ground water availability for future irrigation development (mcm)	0
	State of ground water development (in %)	156.69
	Category	Over-exploited
Supply Side Management	Geographical Area of Block (Sq.km.)	1528.83
	Potential area suitable for recharge (Sq.km.)	312.07
	Thickness of unsaturated zone 3 m below ground level (m)	Limestone – 6.68 Sandstone – 6.68
	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	53.86
	Tanka Structures Proposed for water conservation	2689
Demand side Management	Use of Advanced Irrigation Practices to be promoted	
	(i) Micro-irrigation (through sprinklers)	
	Total Irrigated Area (ha)	24399
	Irrigated Area (ha) proposed for micro-irrigation	6099.75 (25% of net irrigated area)
	Water Saving by Use of Micro-irrigation (mcm)	4.8798
	(ii) Change in Cropping pattern	No Crop Pattern Change Suggested because, Micro-Irrigation suffice for aquifer management.
Expected Benefits	Net G.W. Availability (MCM)	6.9249
	Additional Recharge water from the water conservation structure like Tanka (MCM)	0.1344
	Total Net G.W. Availability after intervention (MCM)	6.9249
	Existing G.W Draft for all purpose (MCM)	9.6312
	Saving of Ground water through demand side intervent ion (MCM)	4.8798
	Net GW draft after interventions (MCM)	4.7514
	Present stage of G.W. development (in %)	156.69
	Expected stage of G.W. Development after supply side management (in %)	154.53
	Expected stage of G.W. Development after supply side and demand side management (in %)	76.24

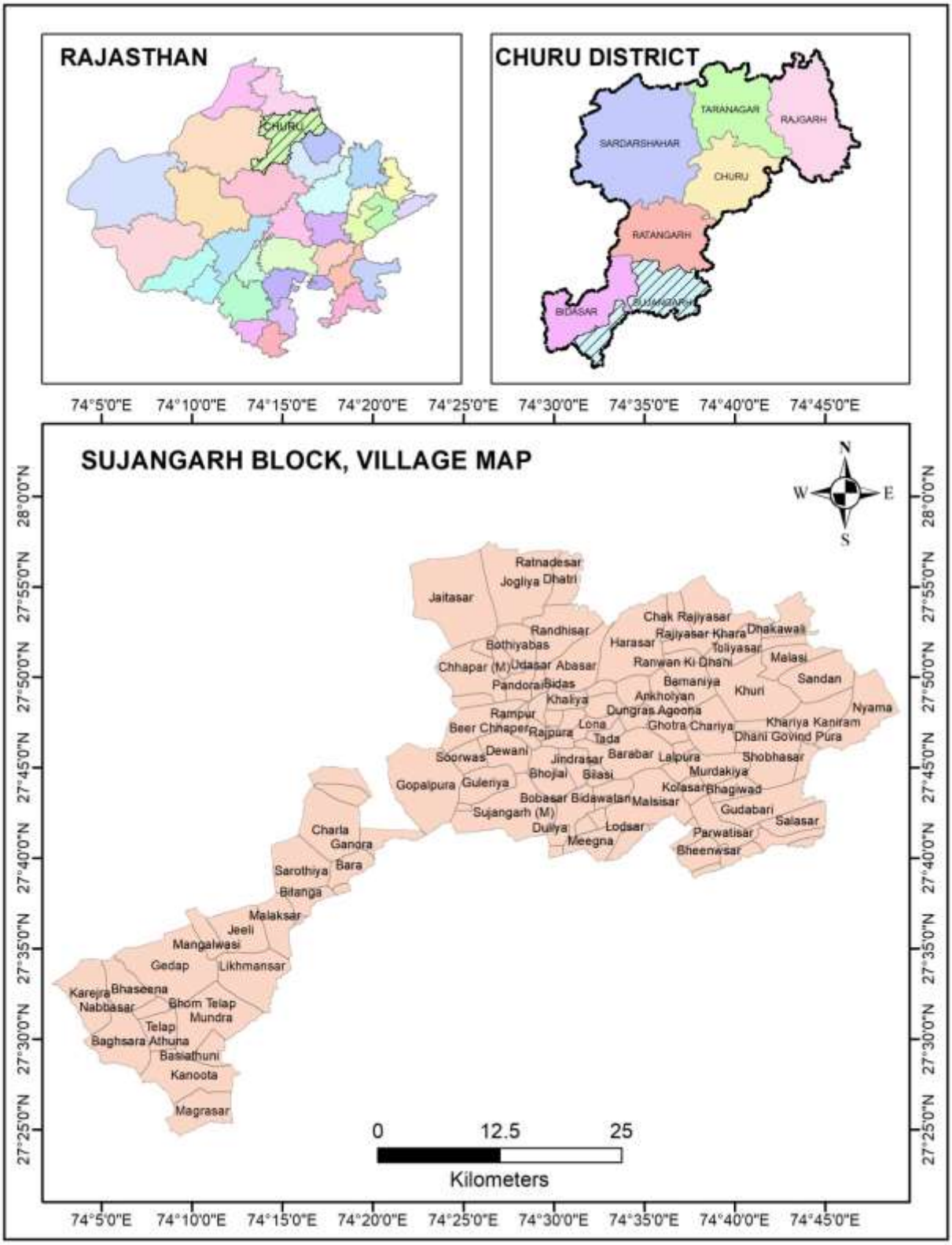


Figure. Index Map of Sujangarh Block, Churu District.

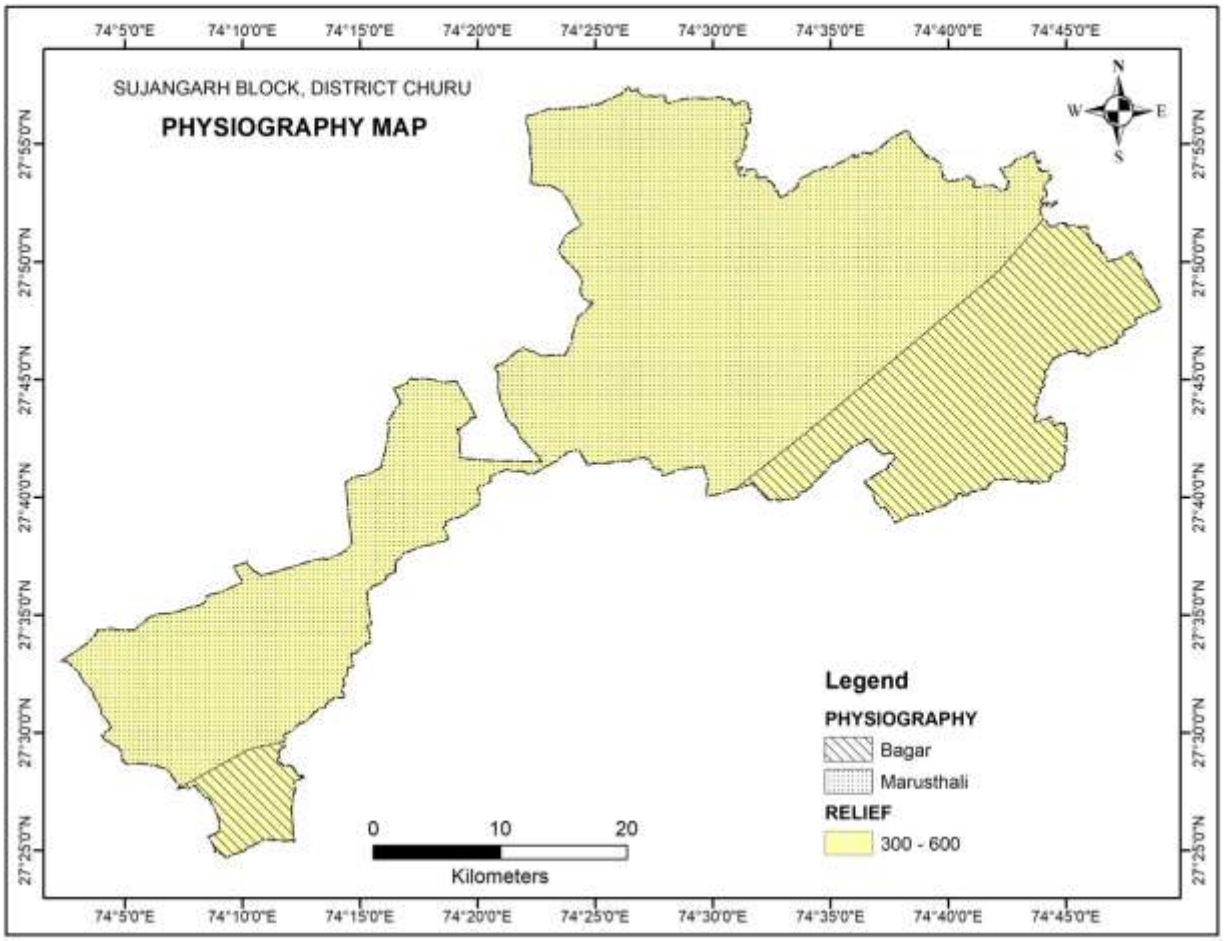


Figure. Physiography Map of Sujangarh Block, Churu District.

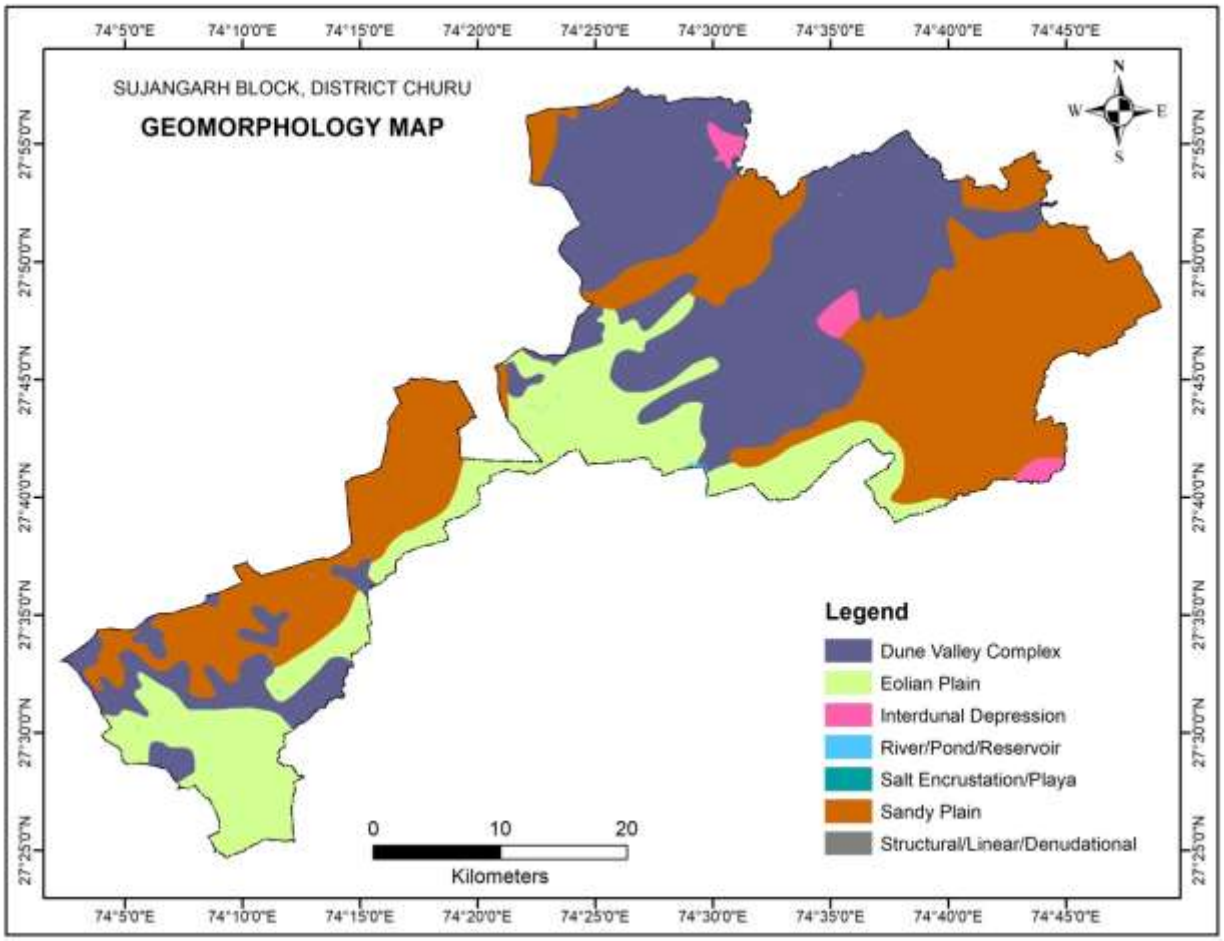


Figure . Geomorphology Map of Sujangarh Block, Churu District.

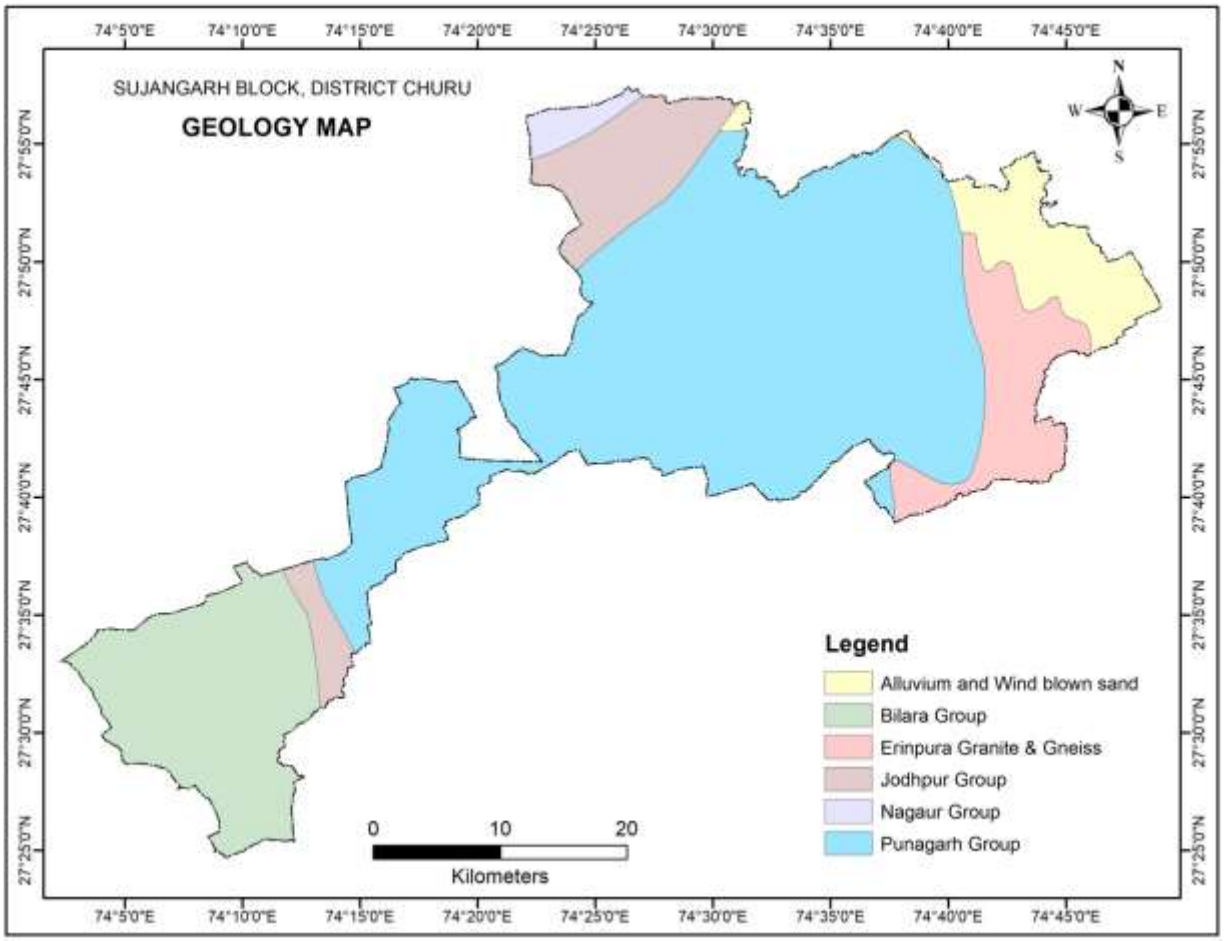


Figure. Geological Map of Sujangarh Block, Churu District.

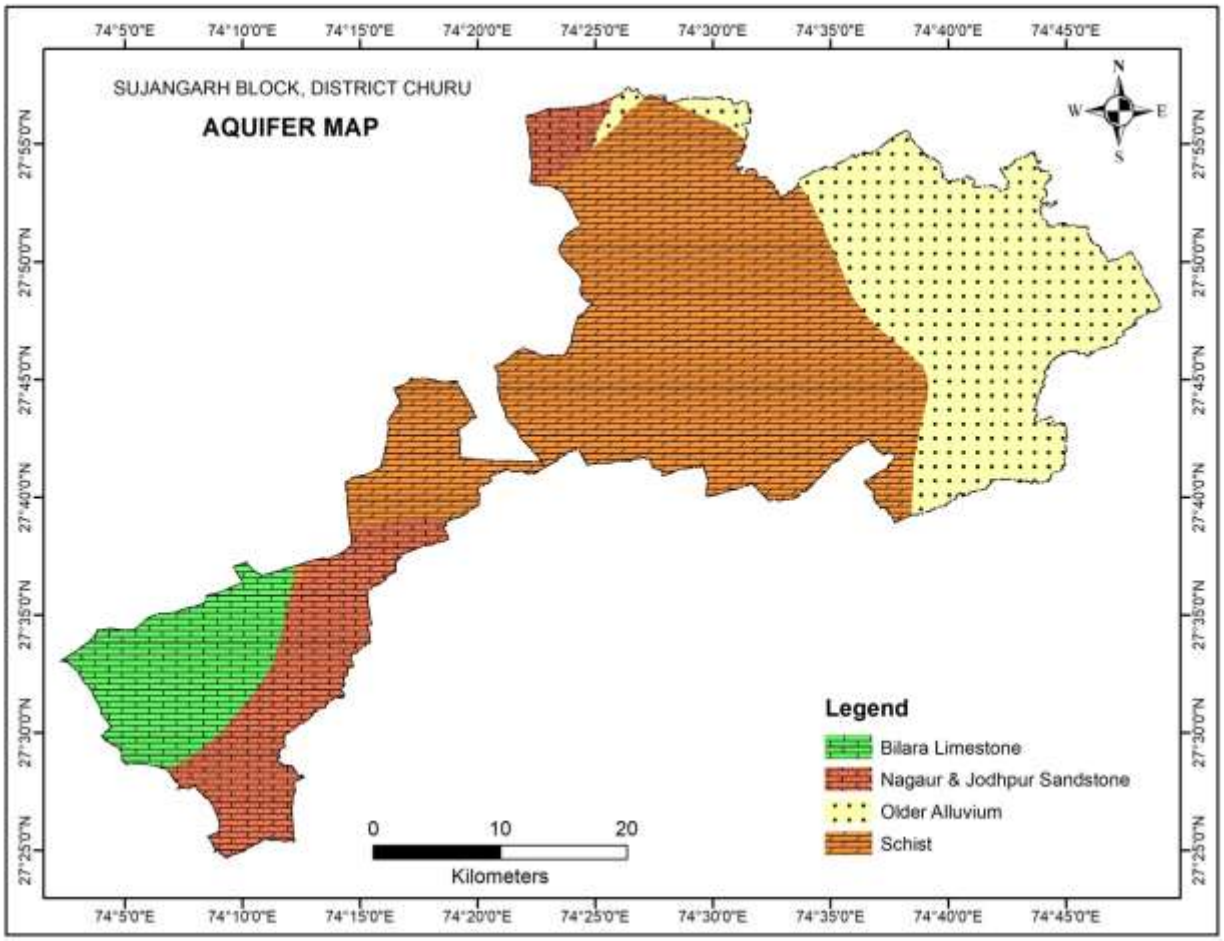


Figure. Aquifer Map of Sujangarh Block, Churu District.

Salient Information	Block - Taranagar	
	Geographical Area (sq. km)	1810.40
	Forest Area (sq. km	5.07
	Potential Area (sq. Km)	0
Climate & Rainfall	Climate	Hot and Dry
	Average Rainfall (1990-2019)	370 mm
Aquifer System	Aquifer Characteristics	Alluvium (saline)
	Main Aquifers in the area	Alluvium
	Aquifer Disposition	
	Maximum Depth of Aquifer (m)	
	Type of Aquifer	Unconfined Aquifer
	Hydraulic Character (Sp. Yield %)	0.070
Water Level Behaviour DTW (m)	Depth to Water Level (m BGL)	12.06
	Trend (m/yr)	-0.05
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	370/9680
	Chloride in mg/litre (Min/Max)	38/1750
	Nitrate in mg/litre (Min/Max)	29/118
	Fluoride in mg/litre (Min/Max)	0.60/1.08
Groundwater Resources	• Groundwater in the entire block is saline no ground water potential zones have been delineated. • No Groundwater resources estimate because water bearing formations are Saline.	
	Category	Saline
Supply Side Management	Geographical Area of Block (Sq.km.)	1810.40
	Potential area suitable for recharge (Sq.km.)	0
	Area feasible for artificial recharge (Sq km)	0
	Thickness of unsaturated zone 3 m below ground level (m)	0
	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	0
	Tanka Structures Proposed for water conservation	3191
Demand side Management	Use of Advanced Irrigation Practices to be promoted	Drip irrigation
	• Salinity tolerate crops are suggested for irrigation and drip irrigation are also suggested.	

	• Rainwater Harvesting and Farm Ponds are suggested.

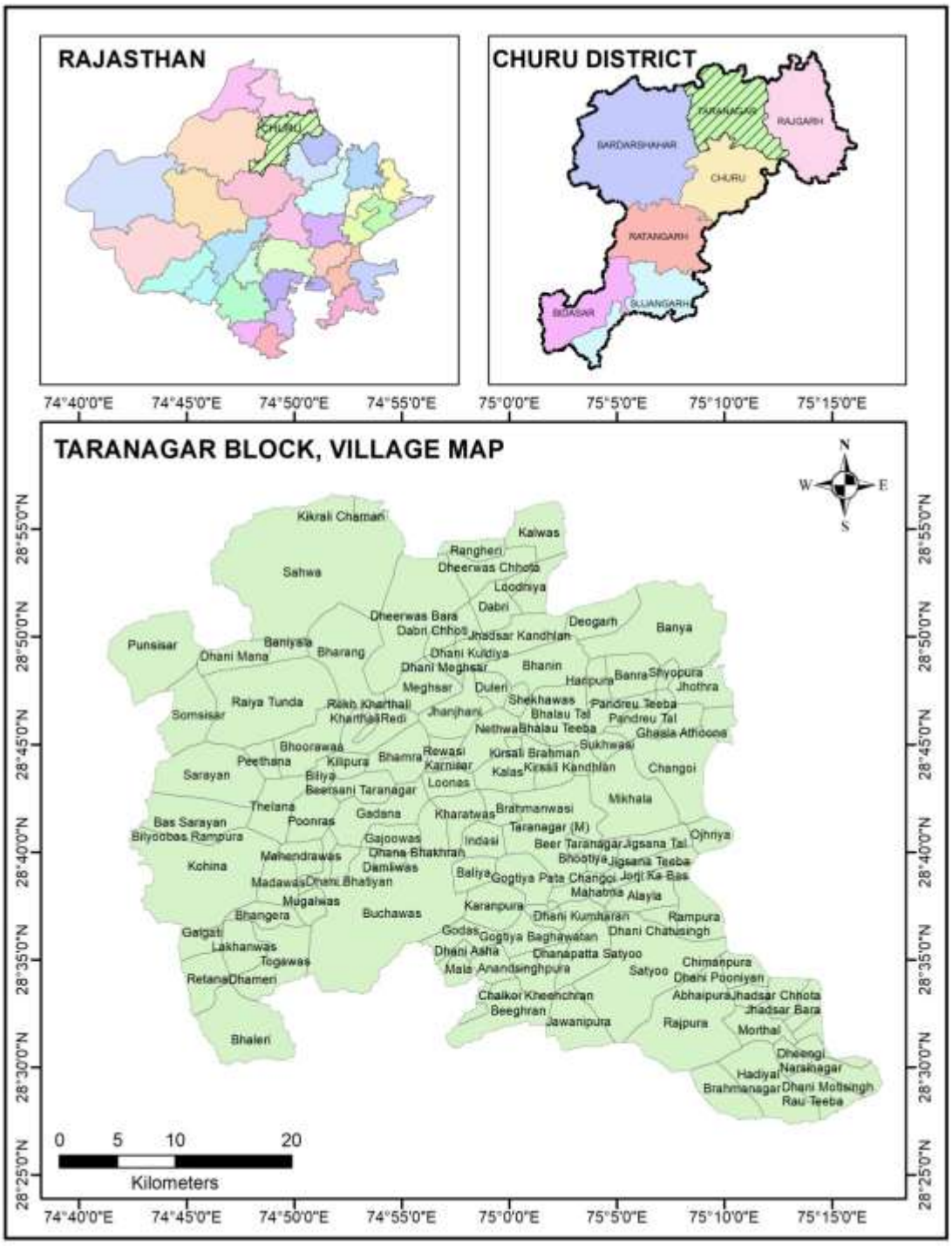


Figure 40. Index Map of Taranagar Block, Churu District.

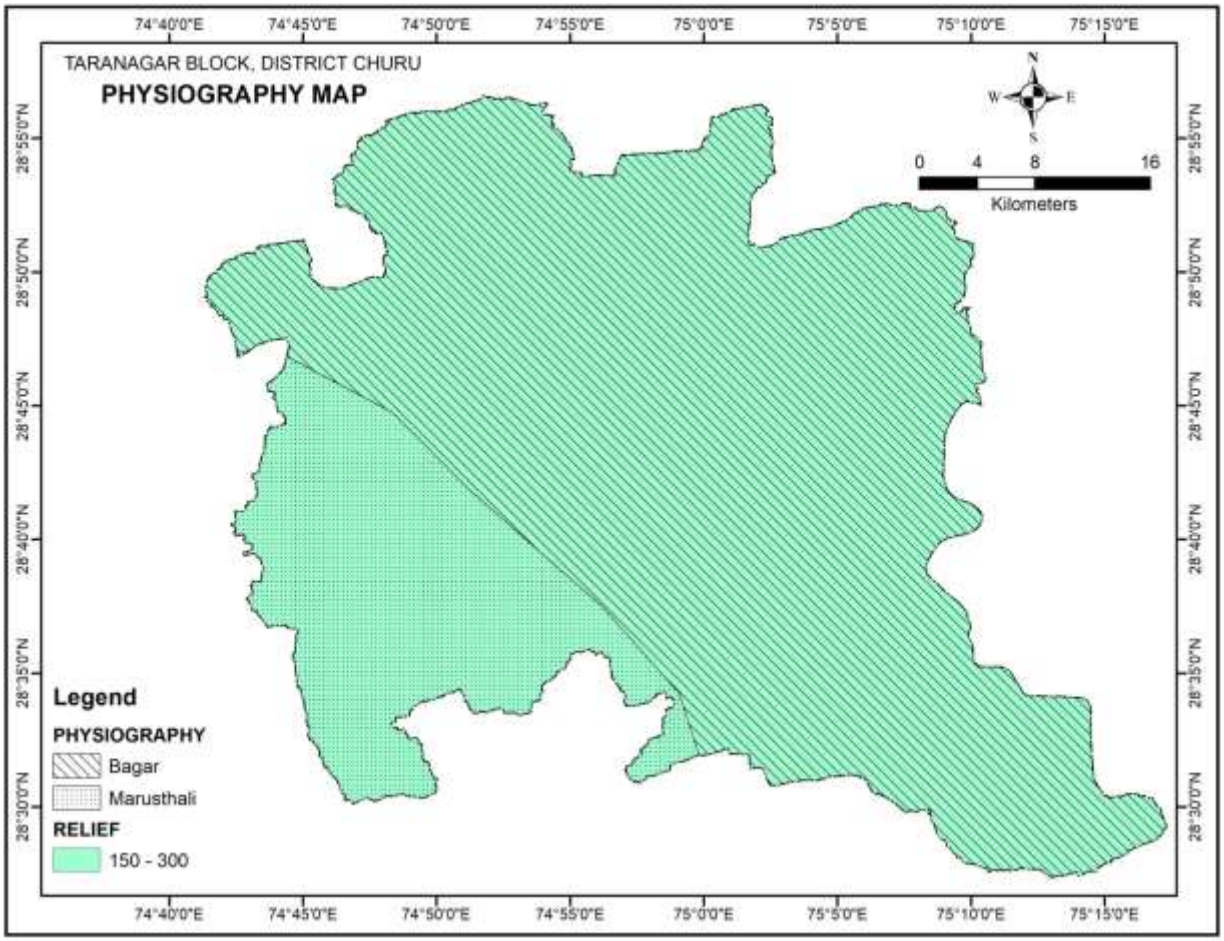


Figure. Physiography Map of Taranagar Block, Churu District.

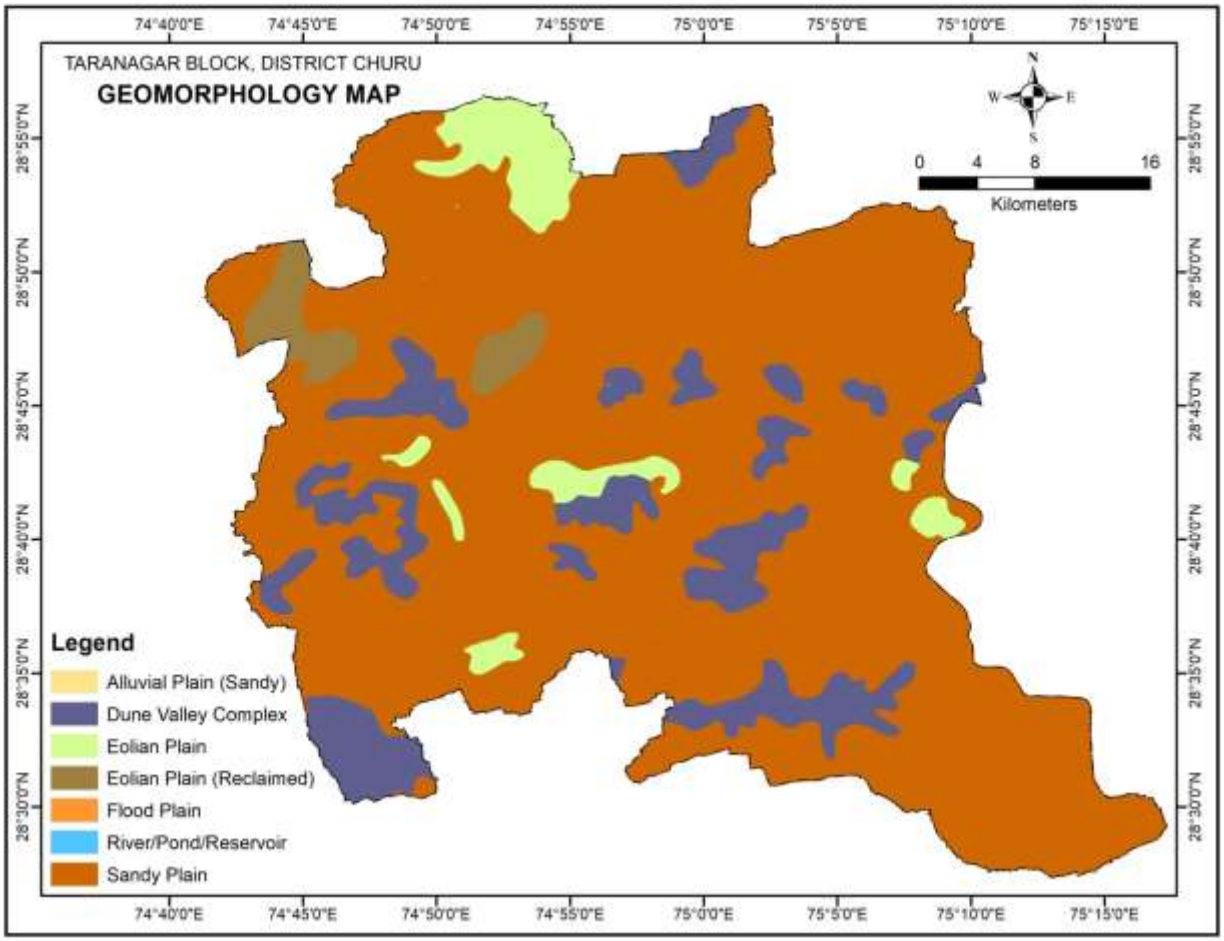


Figure. Geomorphology Map of Taranagar Block, Churu District.

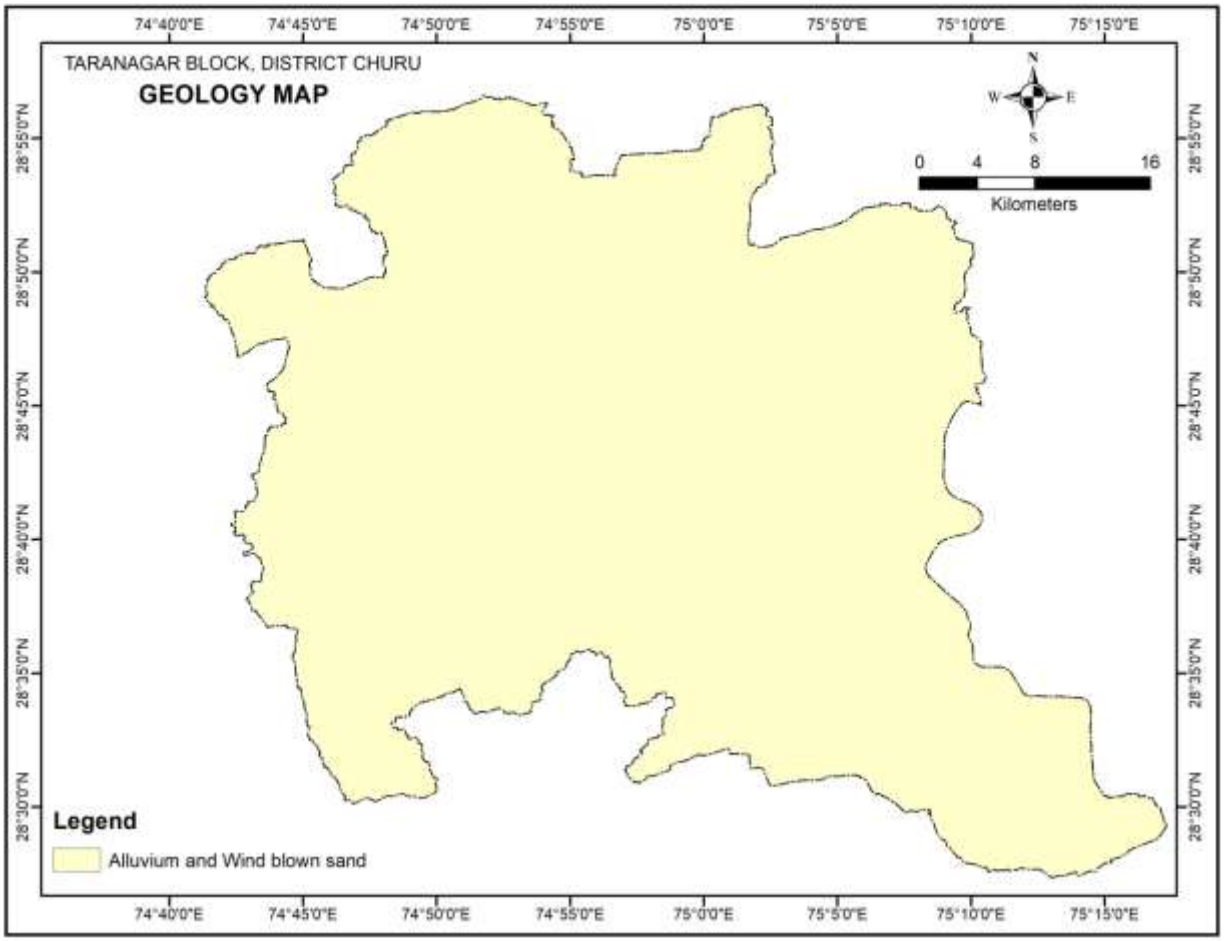


Figure. Geological Map of Taranagar Block, Churu District.

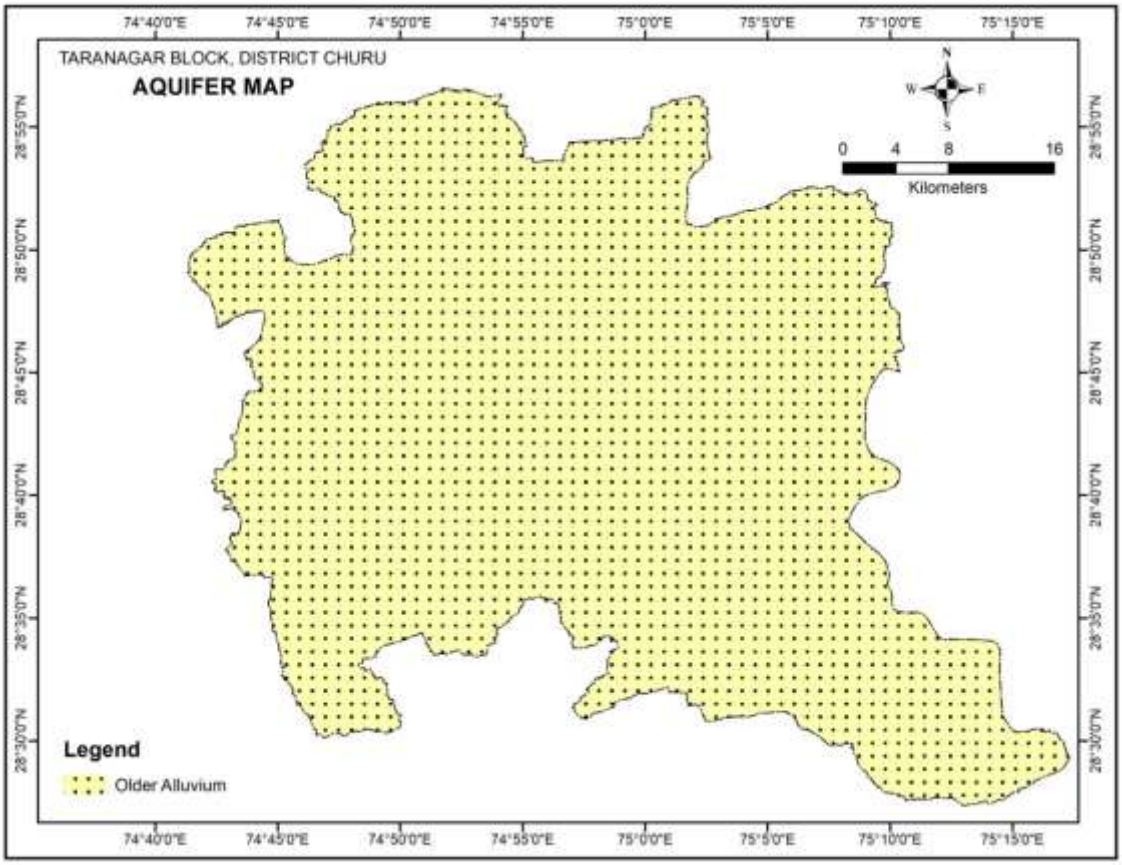


Figure. Aquifer Map of Taranagar Block, Churu District.

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ANNEXURE A: Wells drilled by CGWB and SGWD in Churu District.

DISTRICT	BLOCK_MAP	VILLAGE	LATITUDE	LONGITUDE	DEPTH	AGENCY	TYPE	AQUIFER
CHURU	CHURU	GUJARO KI DHANI	28.2833	74.9000	107.35	CGWB	PZ	ALLUVIUM
CHURU	CHURU	DUDWA KHARA	28.4667	75.0667	92.50	CGWB	PZ	ALLUVIUM
CHURU	CHURU	JASARASAR	28.3000	74.8167	96.81	CGWB	SH	ALLUVIUM
CHURU	CHURU	BALRASAR TANWARAN	28.2667	75.0500	83.00	CGWB	PZ	ALLUVIUM
CHURU	CHURU	BALRASAR ATHUNA	28.3500	74.7833	78.50	CGWB	EW	ALLUVIUM
CHURU	CHURU	ASLU	28.3587	75.0859	100.10	CGWB	EW	ALLUVIUM
CHURU	CHURU	BHARATIA HOSPITAL, CHURU	28.3000	74.9722	121.50	CGWB	EW	ALLUVIUM
CHURU	CHURU	SAHNALI CHHOTI	28.1551	74.8676	115.00	CGWB	EW	ALLUVIUM
CHURU	CHURU	BINJASAR	28.2486	74.8800	189.50	CGWB	EW	ALLUVIUM / SANDSTONE
CHURU	RAJGARH	CHAINPURA CHHOTA	28.7667	75.3500	122.00	CGWB	PZ	ALLUVIUM
CHURU	RAJGARH	DADREWA	28.6333	75.2333	109.12	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	NEEMA	28.4500	75.4833	98.00	CGWB	EW	ALLUVIUM / WEATHERED GRANITE
CHURU	RAJGARH	SANKHU	28.4167	75.3333	110.00	CGWB	PZ	ALLUVIUM
CHURU	RAJGARH	NEEMA	28.4667	75.4667	115.00	CGWB	PZ	ALLUVIUM
CHURU	RAJGARH	RARWA	28.6000	75.4000	107.20	CGWB	EW	ALLUVIUM / MICA SCHIST
CHURU	RAJGARH	KHEJRA	28.6167	75.5167	49.40	CGWB	SH	ALLUVIUM
CHURU	RAJGARH	THIRPALI	28.4000	75.5333	113.86	CGWB	PZ	ALLUVIUM SANDSTONE
CHURU	RAJGARH	NUWA	28.4750	75.5500	115.00	CGWB	PZ	ALLUVIUM SANDSTONE
CHURU	RAJGARH	BHAKRAN	28.5000	75.5500	125.85	CGWB	PZ	ALLUVIUM
CHURU	RAJGARH	DHAN	28.7662	75.3509	24.30	CGWB	PZ	ALLUVIUM
CHURU	RAJGARH	DINGALI	28.4000	75.5000	100.00	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	DOKUWA	28.5833	75.3000	103.61	CGWB	EW	ALLUVIUM

CHURU	RAJGARH	INDPALSAR	28.7761	75.4882	196.20	CGWB	EW	SANDSTONE
CHURU	RAJGARH	HARPALU KUSHALA	28.5500	75.4500	114.50	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	KIRTAN	28.5333	75.6083	110.57	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	NAURANGPURA	28.3667	75.4583	113.65	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	KIRTAN	28.3667	75.4583	104.00	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	LASERI	28.7000	75.4833	110.00	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	SAKHAN TAL	28.3583	75.3958	98.00	CGWB	EW	ALLUVIUM
CHURU	RAJGARH	NASAL BARI	28.6750	75.4111	77.50	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	BIRAMSAR	28.0333	74.7833	96.60	CGWB	SH	ALLUVIUM
CHURU	RATANGARH	RATANGARH	28.0167	74.6167	64.01	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	BANDHAU	28.0333	74.3667	385.00	CGWB	SH	PALANA SANDSTONE
CHURU	RATANGARH	GORISAR	28.1500	74.6667	74.80	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	BANDHAU	28.0333	74.3667	466.00	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	RAJAL DESAR	28.0333	74.4667	68.90	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	RATANGARH	28.0667	74.6000	75.98	CGWB	SH	ALLUVIUM
CHURU	RATANGARH	MELUSAR	28.2000	74.5167	70.00	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	LOHA-I	28.0083	74.6250		CGWB	PZ	-
CHURU	RATANGARH	LOHA-LL	28.0083	74.6250	48.50	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	RATANGARH	28.0167	74.6167	63.50	CGWB	PZ	ALLUVIUM & WEATHERED GRANITE
CHURU	RATANGARH	KANWARI	27.9167	74.6833	52.50	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	SANGASAR	28.0000	74.6667	44.70	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	TIDIYASAR	28.0500	74.7500	111.50	CGWB	PZ	ALLUVIUM
CHURU	RATANGARH	BIRAMSAR	28.0438	74.7915	100.15	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	SHEILA	28.1917	74.7625	102.50	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	BUKHREDI	27.9264	74.8197	104.00	CGWB	EW	ALLUVIUM
CHURU	RATANGARH	PARIHARA	28.1828	74.5750	61.70	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	SARDARSHAHAR-I	28.4500	74.4833	96.01	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	BHANIPUR	28.6167	74.3667	295.45	CGWB	SH	ALLUVIUM
CHURU	SARDARSHAHAR	SARDARSHAHAR-II	28.4500	74.4833	77.72	CGWB	EW	ALLUVIUM

CHURU	SARDARSHAHAR	SARDARSHAHAR	28.4333	74.4833	76.00	CGWB	PZ	ALLUVIUM
CHURU	SARDARSHAHAR	RATANPURA	28.5333	74.2333	91.00	CGWB	PZ	ALLUVIUM
CHURU	SARDARSHAHAR	PAMPALIA-II	28.3833	74.1000	80.20	CGWB	SH	TERTIARY SANDSTONE
CHURU	SARDARSHAHAR	ARSISAR	28.4000	74.1167	232.52	CGWB	SH	SANSTONE
CHURU	SARDARSHAHAR	DULRASAR	28.3000	74.5000	115.50	CGWB	EW	ALLUVIUM SANSTONE
CHURU	SARDARSHAHAR	SOMASAR	28.3833	74.0667	261.00	CGWB	EW	TERTIARY NAGAUR SANDSTONE
CHURU	SARDARSHAHAR	AMRASAR	28.3667	74.2500	200.23	CGWB	EW	SAND/TERTIARY
CHURU	SARDARSHAHAR	NAKRASAR	28.2833	74.5611	90.00	CGWB	PZ	ALLUVIUM SANSTONE
CHURU	SARDARSHAHAR	PAMPALIA-I	28.3833	74.1000	208.20	CGWB	EW	TERTIARY SANDSTONE
CHURU	SARDARSHAHAR	BHOJASAR BARA	28.6833	74.2000	200.40	CGWB	EW	TERTIARY & NAGAUR SANSTONE
CHURU	SARDARSHAHAR	ASPALSAR	28.5783	74.5056	67.00	CGWB	PZ	ALLUVIUM
CHURU	SARDARSHAHAR	BHATWALA	28.7333	74.1833	156.50	CGWB	EW	TERTIARY & NAGAUR SANSTONE
CHURU	SARDARSHAHAR	BARI SAWAI	28.3833	74.4000	100.00	CGWB	EW	NAGAUR SANDSTONE
CHURU	SARDARSHAHAR	ARSISAR	28.4000	74.1167	232.52	CGWB	EW	TERTIARY & NAGAUR SANSTONE
CHURU	SARDARSHAHAR	BHOJRASAR	28.5500	74.4500	141.30	CGWB	EW	NAGAUR SANDSTONE
CHURU	SARDARSHAHAR	PULASAR	28.4000	74.6000	125.90	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	PATAMDESHAR	28.3500	74.1667	232.10	CGWB	EW	TERTIARY SANDSTONE
CHURU	SARDARSHAHAR	KARANSAR	28.4667	74.2333	242.60	CGWB	EW	SANSTONE
CHURU	SARDARSHAHAR	LUNASAR	28.6000	74.2500	193.10	CGWB	EW	NAGAUR SANDSTONE
CHURU	SARDARSHAHAR	RAIKON KI DHANI	28.5833	74.2333	110.00	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	SARSAR	28.3333	74.6667	96.50	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	LUNASAR	28.5642	74.2590	64.50	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	AJITSAR	28.2667	74.6472	93.00	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	JAISINGH NAGAR	28.4579	74.6356	108.00	CGWB	EW	ALLUVIUM
CHURU	SARDARSHAHAR	BHADASAR	28.2958	74.3111	180.30	CGWB	EW	ALLUVIUM
CHURU	SUJANGARH	KOLASAR	27.7563	74.6430	42.98	CGWB	SH	ALLUVIUM
CHURU	SUJANGARH	UDRASAR	27.8498	74.4614	92.00	CGWB	PZ	ALLUVIUM

CHURU	SUJANGARH	KHURI	27.8319	74.7000	58.00	CGWB	PZ	ALLUVIUM
CHURU	SUJANGARH	NIYAMA	27.8054	74.7796	80.90	CGWB	PZ	ALLUVIUM
CHURU	SUJANGARH	UDRASAR	27.8498	74.4614	229.60	CGWB	EW	SANSTONE
CHURU	TARANAGAR	JAITSISAR-I	28.7667	74.7500	127.00	CGWB	EW	ALLUVIUM / CHERTY LIMESTONE
CHURU	TARANAGAR	JAITSISAR-II	28.7500	74.7667	70.43	CGWB	EW	ALLUVIUM / SANDSTONE
CHURU	TARANAGAR	MEGHSAR	28.7958	74.9403	84.00	CGWB	PZ	ALLUVIUM

ANNEXURE B: Annual Rainfall Data (mm) at different Rain Gauge Stations, Churu District.

YEAR	CHURU	RAJGARH	RATANGARH	SARDARSHAHAR	SUJANGARH	TARANAGAR	DISTRICT	
							RAINFALL AVERAGE	DEPARTURE (%)
1990	368.0	428.6	238.0	282.0	422.0	700	406.4	0.0
1991	305.0	299.0	120.0	203.0	391.0	334	275.3	-32.3
1992	394.0	389.0	562.0	489.0	609.0	276	453.2	11.5
1993	511.0	324.0	283.0	283.0	370.0	247	336.3	-17.2
1994	377.0	315.0	359.0	292.0	390.0	568	383.5	-5.6
1995	446.0	369.0	570.0	359.0	724.0	487	492.5	21.2
1996	387.0	358.0	336.0	400.0	518.0	349	391.3	-3.7
1997	624.0	457.0	541.0	404.0	585.0	623	539.0	32.6
1998	650.0	496.0	352.0	383.0	457.0	523	476.8	17.3
1999	226.0	121.0	231.0	170.0	273.0	250	211.8	-47.9
2000	230.0	187.0	184.0	317.0	352.0	127	232.8	-42.7
2001	413.0	465.0	297.0	336.0	276.0	429	369.3	-9.1
2002	288.0	210.0	78.0	110.0	130.0	157	162.2	-60.1
2003	570.0	366.0	446.0	366.0	371.0	363	413.7	1.8
2004	253.0	427.0	250.0	151.0	397.0	300	296.3	-27.1
2005	444.0	437.0	217.0	355.0	370.0	312	355.8	-12.4
2006	251.0	341.0	226.0	243.0	378.0	344	297.2	-26.9
2007	449.0	532.0	415.0	303.0	272.0	460	405.2	-0.3
2008	636.0	648.0	431.0	502.0	294.0	525	506.0	24.5
2009	165.0	315.0	245.0	220.0	317	327	264.8	-34.8
2010	635.0	564.0	713.0	556.0	627.0	802	649.5	59.8
2011	648.0	680.0	533.0	591.0	509.0	1001	660.3	62.5
2012	430.0	431.0	400.0	283.0	665.0	368	429.5	5.7

2013	456.0	453.0	606.0	463.0	564.0	413	492.5	21.2
2014	566.0	502.0	414.0	421.0	461.0	466	471.7	16.1
2015	500.0	453.0	394.0	657.0	554.0	529	514.5	26.6
2016	575.0	746.0	328.0	258.0	407.0	478	465.3	14.5
2017	343.0	571.0	237.0	314.0	395.0	306	361.0	-11.2
2018	394.0	344.0	302.0	272.0	301.0	429	340.3	-16.3
2019	488.0	627.0	330.0	393.0	578.0	391	467.8	15.1
2020	515.0	500.0	442.0	612.0	304.0	485	476.3	17.2
MEAN (MM)	439.0	430.9	361.4	356.9	428.0	422.3	406.4	
STDEV(MM)	139.5	144.1	148.5	136.7	138.9	176.5	118.4	
C.V. (%)	31.8	33.4	41.1	38.3	32.5	41.8	29.1	

ANNEXURE C: List of wells considered for Pre & Post - Monsoon period Water Levels for year 2021.

DISTRICT	BLOCK	VILLAGE	AGENCY	WELL TYPE	LONG	LAT	RL (m)	HYDROGEOLOGICAL FORMATION	TOTAL DEPTH (mbgl)	WL_PRE	WL_POST
CHURU	BIDASAR	BAMBOO	CGWB	DW	27.73330	74.11670	319.00	Limestone	80.00	76.15	75.60
CHURU	BIDASAR	BIDASAR	CGWB	DW	27.83860	74.28330	309.00	Schist	121.92	8.04	7.81
CHURU	Churu	BINASAR	CGWB	DW	28.26250	74.87500	296.00	Older Alluvium	45.00	37.29	33.69

CHURU	Churu	DUDWA KHARA	CGWB	PZ	28.47080	75.07920	276.00	Older Alluvium	92.50	19.89	19.59
CHURU	Churu	SIRSALA	CGWB	DW	28.43330	75.13060	277.00	Older Alluvium	31.69	22.07	29.87
CHURU	Rajgarh	DADREWA	CGWB	DW	28.66940	75.23330	233.00	Older Alluvium	26.00	12.21	10.99
CHURU	Rajgarh	HARPALU KHUSALA	CGWB	PZ	28.53330	75.43890	254.00	Older Alluvium	114.50	42.15	38.65
CHURU	Rajgarh	NANGLI	CGWB	DW	28.63500	75.30000	234.00	Older Alluvium	30.66	24.90	24.28
CHURU	Rajgarh	NEEMA	CGWB	PZ	28.46670	75.47220	270.00	Older Alluvium	115.00	53.56	52.16
CHURU	Rajgarh	RAJGARH1	CGWB	DW	28.63330	75.37500	480.00	Older Alluvium	28.00	23.91	22.31
CHURU	Ratangarh	BHOJASAR	CGWB	DW	27.97220	74.54170	317.00	Older Alluvium	35.00	29.72	29.59
CHURU	Ratangarh	KANWARI	CGWB	PZ	27.91670	74.68330	320.00	Older Alluvium	52.50	28.25	28.20
CHURU	Ratangarh	LOHA	CGWB	DW	28.00830	74.61530	326.00	Older Alluvium	50.00	27.68	28.91
CHURU	Ratangarh	MELUSAR1	CGWB	PZ	28.20420	74.53060	297.00	Older Alluvium	70.00	49.50	42.80
CHURU	Ratangarh	Perihara	CGWB	DW	27.92440	74.56110	323.78	Older Alluvium	27.20	22.70	20.80
CHURU	Ratangarh	RAJALDESAR	CGWB	PZ	28.03750	74.47640	321.00	Older Alluvium	68.90	48.64	48.61
CHURU	Ratangarh	Sangasar	CGWB	PZ	28.00000	74.65670	314.00	Older Alluvium	44.70	30.05	28.97
CHURU	Ratangarh	TIDIYASAR	CGWB	DW	28.06610	74.75390	315.00	Older Alluvium	50.00	47.30	47.35
CHURU	Ratangarh	TIDIYASAR Pz	CGWB	PZ	28.06670	74.73330	315.00	Older Alluvium	111.50	39.75	39.73
CHURU	Sardar Shahar	Aspalsar	CGWB	DW	28.57690	74.50440	241.00	Jodhpur Sandstone	50.00	44.45	43.50
CHURU	Sardar Shahar	MELUSAR	CGWB	DW	28.50420	74.73750	256.00	Older Alluvium	48.00	26.33	21.55
CHURU	Sujangarh	GULERIYA	CGWB	DW	27.73750	74.41860	316.00	Schist	18.00	10.33	9.92
CHURU	Taranagar	BHALAUTIBBA	CGWB	DW	28.76030	75.02720	215.00	Older Alluvium	18.01	15.26	11.97
CHURU	Taranagar	DHIRAWAS	CGWB	DW	28.84170	74.90830	210.00	Older Alluvium	15.20	9.00	8.78
CHURU	Taranagar	SHAWA	CGWB	DW	28.87500	74.84170	212.00	Older Alluvium	29.80	16.40	13.10
Churu	Bidasar	Badhsar	GWD	DW	27.77207	74.36945	-	Nagaur Sst.	54.90	50.80	50.45
Churu	Bidasar	Bamboo	GWD	DW	27.73176	74.11258	322.93	Limestone	80.00	64.85	64.45
Churu	Bidasar	Bidasar	GWD	DW	27.83096	74.31760	304.33	Schist	175.26	8.30	8.20
Churu	Bidasar	Dhani Kumharan	GWD	PZ	27.91250	74.33333	-	Limestone	458.72	127.20	127.10
Churu	Bidasar	Inyara	GWD	PZ	27.68483	74.06991	309.31	Limestone	201.16	124.50	124.10
Churu	Bidasar	Tehindesar	GWD	PZ	27.69990	73.96784	311.23	Nagaur Sst.	83.45	91.70	91.20
Churu	Churu	Asalkheri	GWD	DW	28.26906	75.05112	281.57	Older Alluvium	32.15	29.95	29.65

Churu	Churu	Balarasar Tanwaran	GWD	PZ	28.28129	75.08525	-	Older Alluvium	125.00	42.18	42.08
Churu	Churu	Binasar	GWD	DW	28.26059	74.86671	302.90	Older Alluvium	34.52	36.40	36.15
Churu	Churu	Binasar	GWD	PZ	28.28559	74.86671	-	Older Alluvium	71.80	41.30	41.05
Churu	Churu	Churu	GWD	PZ	28.28559	74.86671	-	Older Alluvium	43.25	40.85	40.70
Churu	Churu	Dandoo	GWD	PZ	28.28365	74.95005	300.85	Older Alluvium	84.35	36.45	36.30
Churu	Churu	Dhadaria Charnan	GWD	PZ	28.25319	74.67855	-	Older Alluvium	83.60	45.30	45.10
Churu	Churu	Dhirasar Charnan	GWD	PZ	28.25430	74.67855	-	Older Alluvium	101.20	50.30	50.00
Churu	Churu	Dudwa Khara	GWD	PZ	28.48239	75.09648	265.52	Older Alluvium	NA	24.80	24.55
Churu	Churu	Gundri Tal	GWD	DW	28.45239	74.89834	281.57	Older Alluvium	26.20	30.40	30.30
Churu	Churu	Kadwasar	GWD	PZ	28.36156	74.98208	292.27	Older Alluvium	31.49	28.30	28.10
Churu	Churu	Khandwa	GWD	DW	28.46821	74.78625	277.18	Older Alluvium	32.40	31.10	31.00
Churu	Churu	Khasoli 2	GWD	PZ	28.27212	75.10453	-	Older Alluvium	48.65	44.45	44.25
Churu	Churu	Kunsisar	GWD	PZ	28.38320	74.77119	281.19	Older Alluvium	100.00	28.40	28.20
Churu	Churu	Lakhau	GWD	PZ	28.35815	75.08413	290.61	Older Alluvium	70.00	37.20	37.10
Churu	Churu	Lalasar	GWD	DW	28.43593	75.03385	-	Older Alluvium	28.50	32.20	32.05
Churu	Churu	Meghsar	GWD	PZ	28.20108	74.91321	308.75	Older Alluvium	75.20	48.65	48.55
Churu	Churu	Ramsara	GWD	PZ	28.25960	74.97579	286.91	Older Alluvium	125.00	33.45	33.35
Churu	Churu	Ranasar	GWD	DW	28.28129	75.08527	288.46	Older Alluvium	36.17	37.40	37.32
Churu	Churu	Ratan Nagar	GWD	PZ	28.20283	74.95058	-	Older Alluvium	52.95	38.25	38.15
Churu	Churu	Sehjoosar	GWD	DW	28.37951	74.96633	297.41	Older Alluvium	39.35	38.50	38.40
Churu	Churu	Sirsala	GWD	PZ	28.43351	75.13793	286.34	Older Alluvium	70.00	32.20	32.10
Churu	Churu	Untuoalia	GWD	PZ	28.23577	75.02161	288.77	Older Alluvium	125.00	32.10	32.00
Churu	Rajgarh	Amarpura	GWD	PZ	28.56396	75.22629	231.02	Older Alluvium	100.00	25.70	25.55
Churu	Rajgarh	Bairasar Chhota -1	GWD	DW	28.53134	75.37787	253.02	Older Alluvium	37.50	33.20	33.10
Churu	Rajgarh	Bangarwas	GWD	PZ	28.52524	75.55036	-	Older Alluvium	90.00	53.95	53.80
Churu	Rajgarh	Bungi	GWD	DW	28.72902	75.27262	228.32	Older Alluvium	27.80	20.80	20.65
Churu	Rajgarh	Chandgothi	GWD	PZ	28.41930	75.50584	-	Older Alluvium	80.10	88.10	88.00
Churu	Rajgarh	Dadrewa	GWD	PZ	28.67486	75.23483	227.08	Older Alluvium	80.00	14.20	14.00
Churu	Rajgarh	Deegli	GWD	PZ	28.39018	75.51313	285.37	Older Alluvium	72.50	74.70	74.55
Churu	Rajgarh	Dhigarla	GWD	DW	28.83928	75.38446	217.30	Older Alluvium	27.65	22.25	22.15

Churu	Rajgarh	Ghanau	GWD	DW	28.77007	75.28070	220.38	Older Alluvium	33.60	20.45	20.30
Churu	Rajgarh	Gothari Bari	GWD	DW	28.76170	75.51749	222.04	Older Alluvium	30.23	26.60	26.55
Churu	Rajgarh	Gothari Chhoti	GWD	DW	28.72548	75.53528	230.49	Older Alluvium	37.55	32.70	32.55
Churu	Rajgarh	Gulpura	GWD	DW	28.70080	75.42027	237.50	Older Alluvium	41.00	37.20	37.05
Churu	Rajgarh	Harpalu Khusala	GWD	PZ	28.55742	75.45042	250.99	Older Alluvium	NA	38.80	38.70
Churu	Rajgarh	Kishanpura	GWD	DW	28.73576	75.34382	222.71	Older Alluvium	27.70	19.10	19.00
Churu	Rajgarh	Lambor Bari	GWD	DW	28.56135	75.37052	247.07	Older Alluvium	34.80	33.70	33.55
Churu	Rajgarh	Lutana Pooran	GWD	DW	28.69662	75.46438	234.30	Older Alluvium	37.13	33.45	33.35
Churu	Rajgarh	Nangal Chhoti	GWD	DW	28.81904	75.49739	223.48	Older Alluvium	36.80	33.75	33.65
Churu	Rajgarh	Navan	GWD	PZ	28.47480	75.54701	248.24	Older Alluvium	125.00	53.90	53.80
Churu	Rajgarh	Raboodi	GWD	PZ	28.35571	75.37739	285.44	Older Alluvium	100.00	40.50	40.40
Churu	Rajgarh	Rawatsar Kunijla	GWD	PZ	28.37799	75.35491	-	Older Alluvium	71.00	34.30	34.20
Churu	Rajgarh	Thirpali Bari	GWD	PZ	28.40262	75.53711	284.50	Older Alluvium	102.50	83.90	83.80
Churu	Ratangarh	Abadsar	GWD	PZ	28.32237	73.89417	217.32	Older Alluvium	125.00	42.90	42.80
Churu	Ratangarh	Bachhrasar	GWD	DW	28.09553	74.76869	307.89	Older Alluvium	43.40	42.40	42.30
Churu	Ratangarh	Beeramsar	GWD	PZ	28.04312	74.71234	307.41	Older Alluvium	87.20	40.90	40.80
Churu	Ratangarh	Chainpura	GWD	PZ	28.19189	74.59292	-	Older Alluvium	81.00	46.70	46.55
Churu	Ratangarh	Ghumanda	GWD	DW	28.09450	74.72114	305.83	Older Alluvium	44.00	40.50	40.38
Churu	Ratangarh	Jandwa	GWD	PZ	28.12639	74.78694	-	Older Alluvium	125.00	43.80	43.70
Churu	Ratangarh	Kangar	GWD	PZ	28.21633	74.63798	299.99	Older Alluvium	80.00	49.45	49.40
Churu	Ratangarh	Kushumdesar	GWD	DW	27.96623	74.72573	334.95	Older Alluvium	36.50	37.40	37.35
Churu	Ratangarh	Mainasar	GWD	DW	27.92856	74.68589	329.75	Older Alluvium	37.27	31.35	30.80
Churu	Ratangarh	Malasar	GWD	PZ	27.92856	74.68589	295.07	Older Alluvium	125.00	45.20	45.10
Churu	Ratangarh	Meloosar	GWD	DW	28.20990	74.53539	309.51	Older Alluvium	47.02	43.90	43.80
Churu	Ratangarh	Parihara	GWD	DW	27.92454	74.56126	323.78	Older Alluvium	27.20	22.10	22.00
Churu	Ratangarh	Sehla	GWD	PZ	28.17004	74.75063	-	Older Alluvium	63.83	44.80	44.70
Churu	Sardar Shahar	Asalsar	GWD	PZ	28.28444	74.50459	278.80	Older Alluvium	125.00	45.10	43.70
Churu	Sardar Shahar	Aspalsar	GWD	DW	28.57686	74.50439	233.19	Jodhpur Sandstone	55.47	45.70	45.55
Churu	Sardar Shahar	Barjangsar	GWD	DW	28.71354	74.43763	214.58	Jodhpur	59.75	48.10	48.00

								Sandstone			
Churu	Sardar Shahar	Bhadasar	GWD	PZ	28.29032	74.30584	-	Nagaur Sst.	125.00	72.95	72.85
Churu	Sardar Shahar	Bhatwala	GWD	PZ	28.74015	74.19495	201.22	Yr. Alluvium	140.00	52.80	52.70
Churu	Sardar Shahar	Billyoowas	GWD	DW	28.72819	74.67656	218.30	Jodhpur Sandstone	52.30	49.10	49.00
Churu	Sardar Shahar	Dhani Pancheran	GWD	DW	28.57260	74.61399	239.25	Jodhpur Sandstone	49.34	44.60	44.50
Churu	Sardar Shahar	Gomatiya	GWD	DW	28.37998	74.37585	247.20	Yr. Alluvium	95.67	92.80	92.65
Churu	Sardar Shahar	Jaisinghsar	GWD	PZ	28.45434	74.63971	255.62	Older Alluvium	100.00	43.80	43.70
Churu	Sardar Shahar	Jaitsisar	GWD	DW	28.76145	74.45022	213.82	Jodhpur Sandstone	57.12	48.80	48.70
Churu	Sardar Shahar	Kanwlasar	GWD	DW	28.45810	74.09358	213.23	Yr. Alluvium	63.60	54.30	54.15
Churu	Sardar Shahar	Karansar	GWD	PZ	28.46154	74.21943	223.30	Yr. Alluvium	150.00	60.70	60.55
Churu	Sardar Shahar	Mehrasar Chacheran	GWD	DW	28.37051	74.53924	265.18	Older Alluvium	55.90	48.10	48.00
Churu	Sardar Shahar	Mehri Purohitan	GWD	DW	28.64243	74.70907	231.53	Jodhpur Sandstone	33.00	31.20	31.10
Churu	Sardar Shahar	Melusar	GWD	DW	28.50203	74.73296	245.30	Older Alluvium	38.00	27.30	27.20
Churu	Sardar Shahar	Naharsar	GWD	PZ			213.62	Yr. Alluvium	150.00	63.40	63.30
Churu	Sardar Shahar	Raipura	GWD	DW	28.80908	74.52126	213.59	Jodhpur Sandstone	65.35	33.50	33.40
Churu	Sardar Shahar	Ranasar Bikan	GWD	PZ	28.32706	74.54423	264.44	Older Alluvium	125.00	39.70	39.55
Churu	Sardar Shahar	Ransisar	GWD	DW	28.65970	74.27980	216.09	Yr. Alluvium	74.69	62.80	62.65
Churu	Sardar Shahar	Simla	GWD	DW	28.69412	74.56965	223.27	Jodhpur Sandstone	54.80	51.20	51.10
Churu	Sardar Shahar	Somasar	GWD	DW	28.38711	74.06817	222.36	Yr. Alluvium	59.80	57.80	57.70
Churu	Sardar Shahar	Tolasar	GWD	PZ	28.75844	74.24131	202.33	Yr. Alluvium	140.50	58.30	58.15
Churu	Sardar Shahar	Udasar Bidawtan	GWD	DW	28.35916	74.49145	257.05	Older Alluvium	38.93	38.60	38.50
Churu	Sardar Shahar	Udsar Lodera	GWD	DW	28.26525	74.09276	241.32	Older Alluvium	39.80	38.00	37.85
Churu	Sujangarh	Bamaniya	GWD	DW	27.78383	74.93335	-	Yr. Alluvium	32.15	29.40	29.25
Churu	Sujangarh	Gulerian	GWD	DW	27.74405	74.45763	316.12	Schist	12.30	10.20	10.10
Churu	Sujangarh	Jindarasar	GWD	DW	27.68008	74.38341	-	Schist	23.80	22.40	22.30

Churu	Sujangarh	Joglia	GWD	DW	27.92986	74.44289	312.25	Schist	43.50	38.10	38.05
Churu	Sujangarh	Kodasar	GWD	DW	27.74194	74.30611	336.21	Schist	42.65	29.50	29.35
Churu	Sujangarh	Kolasar	GWD	DW	27.75219	74.64191	334.86	Schist	34.10	25.50	25.35
Churu	Sujangarh	Magrasar	GWD	PZ	27.44849	74.18193	307.03	Jodhpur Sandstone	125.00	61.50	61.35
Churu	Sujangarh	Salasar	GWD	PZ	27.70422	74.72362	-	Yr. Alluvium	70.00	29.50	29.40
Churu	Sujangarh	Sarotia	GWD	DW	27.67073	74.26370	336.65	Schist	58.60	45.80	45.70
Churu	Taranagar	Bhaleri	GWD	DW	28.54304	74.78579	245.75	Older Alluvium	28.85	26.10	26.00
Churu	Taranagar	Buchawas	GWD	DW	28.61156	74.89001	242.82	Older Alluvium	30.65	28.80	28.70
Churu	Taranagar	Joanipura	GWD	DW	28.52226	75.04823	251.11	Older Alluvium	32.03	25.10	25.05
Churu	Taranagar	Pandreu Tibba	GWD	DW	28.77377	75.02646	225.30	Older Alluvium	24.80	20.70	20.65
Churu	Taranagar	Rajpura	GWD	PZ	28.53648	75.13727	248.36	Older Alluvium	100.00	17.40	17.25
Churu	Taranagar	Satyun	GWD	PZ	28.56116	75.10834	241.30	Older Alluvium	74.64	18.90	18.75
CHURU	BIDASAR	BADSHAR	Keywells	DW	27.58444	73.90778	252.10	Nagaur Sst.	205.74	57.20	58.60
CHURU	BIDASAR	DHADHERU	Keywells	DW	27.96250	74.34083	244.90	Limestone	70.00	65.50	64.10
CHURU	BIDASAR	KALERAN KI DHANI	Keywells	DW	27.89556	74.30417	260.60		80.00	37.40	37.35
CHURU	BIDASAR	LUHARA	Keywells	TW	27.70806	74.24111	224.50		80.00	76.20	76.20
CHURU	BIDASAR	NODIYA	Keywells	TW	27.59278	73.97361	191.80	Nagaur Sst.	121.92	146.30	146.30
CHURU	BIDASAR	PARAWA	Keywells	TW	27.65556	74.21333	237.35	Limestone	175.26	67.05	67.05
CHURU	BIDASAR	SONIYASAR	Keywells	TW	27.76160	74.01110	263.12		106.68	68.58	68.58
CHURU	CHURU	BALRASAR ATHOONA	Keywells	DW	28.34572	74.78534	242.55	Older Alluvium	55.00	35.55	35.50
CHURU	CHURU	CHALKOI BANIROHATAN	Keywells	TW	28.51810	74.96901	223.52	Older Alluvium	36.58	30.48	30.48
CHURU	CHURU	INDRAPURA	Keywells	DW	28.45192	74.99612	244.72	Older Alluvium	30.00	21.98	21.58
CHURU	CHURU	JASRASAR	Keywells	TW	28.29984	74.80799	245.45	Older Alluvium	76.20	41.15	41.15
CHURU	CHURU	KARANPURA	Keywells	DW	28.40552	75.07127	252.72	Older Alluvium	45.00	36.48	33.79
CHURU	CHURU	KHANDWA PATTA	Keywells	DW	28.46547	74.78939	234.72	Older Alluvium	40.00	30.58	30.81
CHURU	CHURU	KHARIYA	Keywells	TW	28.30068	74.87805	249.57	Older Alluvium	41.15	33.53	33.53
CHURU	CHURU	KOTWAD TAL	Keywells	DW	28.54384	74.85821	223.31	Older Alluvium	25.00	17.49	17.12
CHURU	CHURU	NAKRASAR	Keywells	DW	28.28940	74.73418	238.70	Older Alluvium	53.00	50.50	44.99

CHURU	CHURU	RANASAR	Keywells	TW	28.28121	75.08535	256.50	Older Alluvium	67.05	38.70	38.70
CHURU	CHURU	SAHJUSAR	Keywells	DW	28.38077	74.97050	251.12	Older Alluvium	50.00	35.28	35.07
CHURU	CHURU	SAHNALI BADI	Keywells	TW	28.18601	74.86414	261.78	Older Alluvium	68.58	39.62	39.62
CHURU	CHURU	SATDA	Keywells	TW	28.21503	74.80640	253.80	Older Alluvium	76.20	44.20	44.20
CHURU	CHURU	SOMASI	Keywells	DW	28.40957	74.89202	244.93	Older Alluvium	36.57	33.57	33.57
CHURU	RAJGARH	DADREWA	Keywells	TW	28.66688	75.23545	221.91	Older Alluvium	21.34	18.29	18.29
CHURU	RAJGARH	DHANA	Keywells	DW	28.76833	75.35417	201.58	Older Alluvium	35.00	27.42	27.31
CHURU	RAJGARH	GAGARWAS	Keywells	DW	28.65442	75.51809	205.96	Older Alluvium	50.00	38.54	44.40
CHURU	RAJGARH	GUGALWA	Keywells	DUG	28.54641	75.60826	183.40	Older Alluvium	106.68	76.20	75.20
CHURU	RAJGARH	KHUDDI	Keywells	DW	28.72472	75.30111	211.50	Older Alluvium	25.00	13.50	14.53
CHURU	RAJGARH	LAMBA KI DHANI	Keywells	DW	28.48655	75.27909	228.55	Older Alluvium	40.00	28.95	28.77
CHURU	RAJGARH	MANGLA	Keywells	TW	28.67889	75.36000	207.53	Older Alluvium	32.00	30.17	30.17
CHURU	RAJGARH	PABASI	Keywells	DW	28.63520	75.20242	221.80	Older Alluvium	30.00	21.30	21.10
CHURU	RAJGARH	REJRI	Keywells	DW	28.94117	75.45266	186.89	Older Alluvium	34.00	17.51	16.39
CHURU	RAJGARH	SANKHU	Keywells	DW	28.42958	75.34317	235.75	Older Alluvium	50.00	38.55	38.35
CHURU	RAJGARH	SEOWA	Keywells	DW	28.63572	75.15573	217.35	Older Alluvium	40.00	27.95	28.93
CHURU	RAJGARH	SIDMUKH	Keywells	DW	28.88766	75.28789	190.10	Older Alluvium	22.00	14.20	5.76
CHURU	RAJGARH	SULKHANIYA BADA	Keywells	TW	28.39988	75.43680	216.20	Older Alluvium	106.68	64.00	64.00
CHURU	RAJGARH	TAMBA KHERI	Keywells	DW	28.90961	75.42110	187.99	Older Alluvium	50.00	19.01	13.68
CHURU	RAJGARH	THAAN MATHOOI	Keywells	DW	28.63277	75.44926	204.24	Older Alluvium	47.00	42.56	42.06
CHURU	RATANGARH	ALSAR	Keywells	TW	27.99255	74.34368	134.06	Older Alluvium	259.08	167.64	167.64
CHURU	RATANGARH	BALRAMPURA	Keywells	TW	28.12844	74.41554	152.67	Older Alluvium	243.84	147.83	147.83
CHURU	RATANGARH	BHANUDA BIDAWATAN	Keywells	TW	28.19123	74.42646	108.92	Older Alluvium	381.00	182.88	182.88
CHURU	RATANGARH	DAUSAR	Keywells	DUG	28.19168	74.68173	239.94	Older Alluvium	85.34	60.96	60.96
CHURU	RATANGARH	GOLSAR	Keywells	TW	28.15083	74.56167	252.28	Older Alluvium	60.96	45.72	45.72
CHURU	RATANGARH	HAMOOSAR	Keywells	TW	28.18451	74.46499	167.08	Older Alluvium	243.84	121.92	121.92
CHURU	RATANGARH	LACHHARSAR	Keywells	TW	28.10339	74.35792	104.08	Older Alluvium	304.80	192.02	192.02
CHURU	RATANGARH	LADHASAR	Keywells	TW	28.14556	74.62972	267.13	Older Alluvium	64.01	42.67	42.67
CHURU	RATANGARH	PABUSAR	Keywells	DW	28.21687	74.49723	239.29	Older Alluvium	182.88	53.11	50.71

CHURU	RATANGARH	PARSANAEU	Keywells	TW	28.05682	74.36381	144.30	Older Alluvium	274.32	152.40	152.40
CHURU	RATANGARH	RATANGARH TOWN	Keywells	TW	28.07713	74.59878	270.18	Older Alluvium	48.77	39.62	39.62
CHURU	SARDARSHAHAR	ADSISAR	Keywells	DW	28.40625	74.12526	176.44		70.10	54.86	57.07
CHURU	SARDARSHAHAR	BHANIPURA	Keywells	TW	28.62372	74.37002	151.01		106.68	64.09	64.09
CHURU	SARDARSHAHAR	BHOJOOSAR UPADHIYAN	Keywells	TW	28.30455	74.36133	158.07	Nagaur Sst.	335.28	103.63	103.63
CHURU	SARDARSHAHAR	BHOJRASAR	Keywells	TW	28.54516	74.44293	216.71	Yr. Alluvium	70.10	12.19	12.19
CHURU	SARDARSHAHAR	BOGHERA	Keywells	DW	28.71463	74.60340	175.25		55.00	47.65	45.67
CHURU	SARDARSHAHAR	DHANI DEGAN	Keywells	TW	28.27262	74.49140	172.32	Jodhpur Sandstone	182.88	106.68	106.68
CHURU	SARDARSHAHAR	DHANI DOODGIRI	Keywells	DW	28.61524	74.61280	178.40		60.00	50.40	50.71
CHURU	SARDARSHAHAR	DHANI PANCHERAN	Keywells	DW	28.50431	74.53924	206.56	Jodhpur Sandstone	50.00	43.54	41.32
CHURU	SARDARSHAHAR	GHADSISAR	Keywells	TW	28.41189	74.20735	164.44		67.06	60.96	60.96
CHURU	SARDARSHAHAR	JAITASAR	Keywells	TW	28.78497	74.32520	149.84		85.34	54.86	54.86
CHURU	SARDARSHAHAR	KANWALASAR	Keywells	TW	28.43115	74.11360	165.54	Yr. Alluvium	85.34	54.86	54.86
CHURU	SARDARSHAHAR	KARANSAR	Keywells	TW	28.46083	74.21978	180.71	Yr. Alluvium	91.44	48.79	48.79
CHURU	SARDARSHAHAR	KHEJRA	Keywells	DW	28.62190	74.52139	190.46		60.00	46.44	44.51
CHURU	SARDARSHAHAR	MALKASAR	Keywells	TW	28.55420	74.30246	151.91	Yr. Alluvium	94.49	64.09	64.09
CHURU	SARDARSHAHAR	MALSAR	Keywells	TW	28.57866	74.35736	147.72		124.97	68.58	68.58
CHURU	SARDARSHAHAR	MEHRASAR UPADHIYAN	Keywells	TW	28.79734	74.64257	167.53	Older Alluvium	89.92	48.77	48.77
CHURU	SARDARSHAHAR	PATLISAR CHOTTA	Keywells	TW	28.29260	74.39348	185.01	Nagaur Sst.	274.32	95.09	95.09
CHURU	SARDARSHAHAR	POONUSAR	Keywells	Dug	28.46947	74.28177	174.64		182.88	54.86	54.86
CHURU	SARDARSHAHAR	PULASAR	Keywells	DW	28.40939	74.61036	218.37	Older Alluvium	65.00	43.03	DRY
CHURU	SARDARSHAHAR	RAJASAR BHEEKAN	Keywells	TW	28.39449	74.30040	185.69	Yr. Alluvium	323.09	57.91	57.91
CHURU	SARDARSHAHAR	RAJASAR PANWARAN	Keywells	TW	28.61890	74.23057	115.14	Yr. Alluvium	121.92	99.06	99.06
CHURU	SARDARSHAHAR	RAMSISAR BHEDWALIYA	Keywells	TW	28.46816	74.34597	173.74	Yr. Alluvium	91.44	60.96	60.96
CHURU	SARDARSHAHAR	SADASAR	Keywells	TW	28.70241	74.36150	160.59		67.06	57.91	57.91
CHURU	SARDARSHAHAR	SAWAI BADI	Keywells	TW	28.39588	74.42542	132.08	Jodhpur	60.96	121.92	121.92

								Sandstone			
CHURU	SARDARSHAHAR	SHIMLA	Keywells	DW	28.68830	74.56862	213.90	Jodhpur Sandstone	198.12	48.70	48.61
CHURU	SARDARSHAHAR	SOMASAR	Keywells	TW	28.38968	74.06877	162.84	Yr. Alluvium	55.00	60.96	60.96
CHURU	SARDARSHAHAR	UDASAR BIDAWATAN	Keywells	DW	28.37314	74.69115	185.41	Older Alluvium	91.44	38.79	38.05
CHURU	SARDARSHAHAR	UDSAR LODERA	Keywells	DW	28.45757	74.56633	234.81	Older Alluvium	45.00	37.29	36.57
CHURU	SUJANGARH	ABASAR PHANTA	Keywells	TW	27.86972	74.50972	291.50	Schist	39.60	25.90	25.90
CHURU	SUJANGARH	BARABAR	Keywells	DW	27.78139	74.57083	301.05	Schist	30.00	18.95	15.05
CHURU	SUJANGARH	BOBASAR	Keywells	DW	27.71778	74.54472	306.50	Schist	12.00	8.30	6.97
CHURU	SUJANGARH	GOPALPURA	Keywells	DW	27.73694	74.37556	305.15		50.00	42.85	40.05
CHURU	SUJANGARH	HARASAR	Keywells	DW	27.86972	74.50972	289.25		35.00	28.15	17.80
CHURU	SUJANGARH	JAITASAR	Keywells	DW	27.91028	74.41889	266.90		60.00	45.00	44.95
CHURU	SUJANGARH	JOGALIA	Keywells	DW	27.92972	74.44278	273.90	Schist	52.00	40.00	39.80
CHURU	SUJANGARH	Karejra	Keywells	TW	27.56639	74.07917	183.19		285.29	134.11	134.11
CHURU	SUJANGARH	KHURI	Keywells	DW	27.83583	74.69472	295.50		45.72	35.80	32.95
CHURU	SUJANGARH	KODASAR	Keywells	DW	27.74194	74.30611	306.90	Schist	42.00	30.90	24.14
CHURU	SUJANGARH	KOLASAR	Keywells	DW	27.75194	74.64167	304.20	Schist	59.00	26.10	25.50
CHURU	SUJANGARH	LIKHMANSAR	Keywells	TW	27.57222	74.21917	160.36	Jodhpur Sandstone	213.36	167.64	167.64
CHURU	SUJANGARH	MALSISAR	Keywells	DW	27.74972	74.58222	303.70		50.00	23.60	23.63
CHURU	SUJANGARH	Rajiyasar meetha	Keywells	DW	27.89667	74.63028	291.20		33.00	23.10	21.55
CHURU	SUJANGARH	SAROTHIYA	Keywells	DW	27.67056	74.26361	292.00	Schist	59.00	45.60	45.00
CHURU	SUJANGARH	SOBHASAR	Keywells	TW	27.75972	74.71944	298.55	Yr. Alluvium	45.00	34.55	34.55
CHURU	SUJANGARH	SUJANGARH TOWN	Keywells	TW	27.70667	74.48028	307.75	Schist	20.00	8.55	9.40
CHURU	SUJANGARH	TELAP	Keywells	TW	27.54583	74.14222	133.42		304.80	182.88	182.88
CHURU	TARANAGAR	BHEEGRAN	Keywells	TW	28.55329	75.01693	225.32	Older Alluvium	39.62	30.48	30.48
CHURU	TARANAGAR	CHANGOI	Keywells	DW	28.71478	75.11028	211.80	Older Alluvium	30.00	11.50	11.23
CHURU	TARANAGAR	GOGATIYA CHARNAN	Keywells	DW	28.62392	75.04665	220.31	Older Alluvium	35.00	19.69	19.69
CHURU	TARANAGAR	HADIYAL	Keywells	TW	28.49148	75.20391	229.17	Older Alluvium	35.05	33.53	33.53
CHURU	TARANAGAR	KHARATWAS	Keywells	DW	28.68191	74.97330	211.70	Older Alluvium	35.00	24.70	22.48

CHURU	TARANAGAR	KHICHI COLONY	Keywells	TW	28.66123	75.07714	209.32	Older Alluvium	30.48	18.28	18.28
CHURU	TARANAGAR	PUNSISAR	Keywells	DW	28.82245	74.70036	178.10	Older Alluvium	60.00	47.40	47.76
CHURU	TARANAGAR	RAIYA TUNDA	Keywells	TW	28.78084	74.79995	187.87	Older Alluvium	35.05	27.43	27.43
CHURU	TARANAGAR	TARANAGAR TOWN	Keywells	TW	28.68790	75.03420	217.21	Older Alluvium	21.34	18.29	18.29
CHURU	TARANAGAR	TOGAWAS	Keywells	TW	28.57264	74.81514	204.48	Older Alluvium	60.96	45.72	45.72

ANNEXURE D: Pre-Monsoon - Water Quality Parameters of Ground Water Samples of Churu District.

Location	Lat.	Long.	Temp.	pH*	EC* µS/cm at 25°C	CO_3	HCO_3	Cl*	SO_4	NO_3*	PO_4	F*	TH*	Ca*	Mg*	Na*	K*	TDS
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LUHARA	27.7081	74.2411	28	7.26	1580	NIL	353.8	276.51	160	0.52	0.04	0.34	430	116	34.048	190	4.05	1027
PARAWA	27.6556	74.2133	28	7.37	4000	NIL	463.6	900.43	120	440	0.05	1	1020	144	160.512	510	4.4	2600
PAREWARA	27.6778	74.1197	28	7.36	1940	NIL	256.2	347.41	271	45	0.34	1.67	410	84	48.64	280	4.28	1261
INYARA	27.6856	74.0683	29	7.17	3610	NIL	158.6	623.92	898.56	18	0.02	1	1180	284	114.304	355	9.68	2346.5
BADSHAR	27.5842	73.9072	28	7.3	4360	NIL	207.4	843.71	472	440	0.03	4.68	710	116	102.144	690	7.56	2834
BADSHAR	27.5844	73.9078	28	7.38	1312	NIL	244	141.8	41	260	0.05	4.5	160	24	24.32	230	4.28	852.8
NODIYA	27.5928	73.9736	27	7.16	3170	NIL	170.8	460.85	938.88	4	0.06	0.67	1220	288	121.6	250	8.54	2060.5
KALERAN KI DHANI	27.8956	74.3042	30	7.34	5550	NIL	244	1616.5	432	64	0.01	2.1	2140	224	384.256	385	8.91	3607.5
DHADHERU	27.9625	74.3408	30	7.42	1210	NIL	329.4	184.34	49	69	0.22	0.25	290	60	34.048	156	7.27	786.5
BIDASAR	27.8386	74.2833	28	8.00	4480	Nil	268	865	133	850	0.01	1.00	1220	124	221.312	470	20.7	2912
RANASAR	28.281213	75.085346	31	7.69	4570	NIL	842	624	471	275	0.07	0.60	920	112	160	625	6.6	2971

KARANPURA	28.405518	75.071272	27	7.49	11770	NIL	342	3084	1160	26	0.12	1.13	3100	220	619	1288	9	7651
SAHJUSAR	28.380772	74.9705	30	7.736	3940	NIL	439	666	415	294	0.004	0.03	1100	176	160	391	17	2561
INDRAPURA	28.451922	74.99612	29	7.74	5360	NIL	537	950	558	388	0.054	1.71	800	100	134	874	10	3484
CHALKOI BANIROHATAN	28.518095	74.969011	28	7.76	15880	NIL	744	3935	1584	140	0.088	1.50	1450	200	231	2990	8.7	10322
KOTWAD TAL	28.543835	74.858206	30	8.01	10240	NIL	830	2056	752	924	0.019	4.06	1150	160	182	1840	8	6656
KHANDWA PATTA	28.46547	74.78939	28	7.47	7790	NIL	293	1673	1040	260	0.11	0.35	1480	320	165	1113	9	5064
SOMASI	28.409565	74.892015	29	7.95	3900	NIL	403	482	544	460	0.024	0.68	600	96	87	524	175	2535
KHARIYA	28.300683	74.878054	29	7.57	12100	NIL	244	2938	1632	6.01	0.082	0.77	2500	320	413	1633	36	7865
BALRASAR ATHOONA	28.345717	74.785341	30	7.78	3340	NIL	439	539	478	64	0.041	0.15	460	64	73	556	14	2171
NAKRASAR	28.289396	74.734178	30	7.85	7800	NIL	537	1319	1296	270	0.11	0.88	920	120	151	1372	8.3	4797
SATDA	28.21503	74.806397	28	7.73	5910	NIL	903	1035	576	163	0.12	0.25	920	128	146	934	7.7	3842
SAHNALI BADI	28.186006	74.864143	28	7.91	7180	NIL	683	1191	1152	187	0.091	0.67	1068	140	174	1168	11	4667
JASRASAR	28.299843	74.807987	28	7.25	3470	NIL	366	411	684	176	0.021	0.00	780	104	126	452	6.5	2210
MANGLA	28.678889	75.36	28	7.6	19500	NIL	46	4963	2496	118	0.041	0.21	3250	240	643	2995	5.3	12675
KHUDDI	28.724722	75.301111	28	8.27	1150	NIL	329	92	142	28	0.021	0.96	160	16	29	192	2.1	748
DHANA	28.768333	75.354167	28	7.25	4690	NIL	342	638	760	454	0.022	2.01	1000	168	141	612	21	3055
SIDMUKH	28.887656	75.287888	27	7.61	3900	NIL	744	666	368	16	0.066	0.18	880	152	121	446	91	2399
TAMBA KHERI	28.909605	75.421095	29	7.68	5500	NIL	439	539	636	1160	0.041	2.56	1340	192	209	634	17	3575
REJRI	28.94117	75.452662	29	7.56	6970	NIL	415	1517	940	30	0.021	0.02	1100	160	170	1101	25	4050
GUGALWA	28.54641	75.608256	28	7.9	2400	NIL	439	319	256	147	0.044	1.68	180	32	24	469	6.3	1560
GAGARWAS	28.654423	75.51809	29	7.83	2280	NIL	293	376	299	68	0.047	0.40	310	52	44	385	5.6	1456
THAAN MATHOOI	28.632766	75.449262	29	8.41	9820	60	427	2552	412	511	0.11	0.41	1650	240	255	1498	5.6	6383
LAMBA KI DHANI	28.486552	75.279086	30	8.03	9400	NIL	805	1631	1112	715	0.215	1.67	1000	120	170	1715	7.3	6110
SANKHU	28.429582	75.343169	29	8.14	3800	NIL	634	411	480	324	0.155	2.30	200	36	27	787	3.1	2470
SULKHANIYA BADA	28.39988	75.436795	30	8.11	1800	NIL	378	241	206	23	0.112	5.40	280	48	39	286	1.2	1170
SEOWA	28.635723	75.155729	30	7.17	2900	NIL	232	524	336	188	0.092	0.88	830	100	141	253	61	1885
PABASI	28.635195	75.202421	28	7.45	660	NIL	220	50	61	19	0.955	0.01	210	36	29	48	18	429
HARPALU	28.5574	75.4504	29	7.92	9160	NIL	1061	1489	1512	29	0.084	0.95	850	160	109	1725	5.6	5954
NIMA	28.472677	75.483736	30	8.46	4140	120	525	610	476	98	0.012	2.23	380	40	68	782	3.5	2691

DADREWA	28.666879	75.235448	29	7.9	5960	NIL	549	1631	202	108	1.6	1.4	700	120	97.28	1081	2.3	3874
PABUSAR	28.216867	74.497227	31	8.01	2400	NIL	781	277	77	103	0.042	1.89	180	28	27	470	3.9	1560
HAMOOSAR	28.184512	74.464988	29	8.09	2800	NIL	793	383	164	42	0.061	1.46	170	28	24	572	3.7	1820
BHANUDA BIDAWATAN	28.191234	74.426459	31	7.54	3470	NIL	220	695	398	194	0.031	0.45	760	120	112	463	6.7	2256
BALRAMPURA	28.128437	74.415543	30	7.71	1270	NIL	293	170	78	87	0.034	0.49	160	36	17	218	3.4	826
LACHHARSAR	28.103386	74.35792	26	7.65	1400	NIL	342	241	52	26	0.032	0.80	330	60	44	169	4.7	910
PARSANAEU	28.05682	74.363809	26	8.19	1250	NIL	342	170	72	33	0.047	0.68	150	24	22	218	3.4	813
ALSAR	27.992549	74.34368	31	7.7	1160	NIL	293	156	65	63	0.012	0.23	330	60	44	112	6.5	754
RATANGARH TOWN	28.0771	74.5988	29	7.2	3560	NIL	683.2	616.83	249.6	200	0.1	2.17	480	72	72.96	630	6.35	2314
MALASAR	28.2397	74.5782	28	7.74	3200	NIL	634.4	631.01	126.72	175	0.05	1.3	160	28	21.888	700	4.76	2080
KANGAR	28.2133	74.637	27	7.59	2400	NIL	524.6	475.03	115.2	50	0.04	2.32	120	20	17.024	525	4.5	1560
DAUSAR	28.1917	74.6817	29	7.6	2900	NIL	488	631.01	140.64	65	0.06	0.57	300	40	48.64	545	5.43	1885
MELUSAR	28.2125	74.5683	29	7.57	1750	NIL	451.4	276.51	114	30	0.42	1.15	140	20	21.888	350	4.4	1137.5
GOLSAR	28.1508	74.5617	27	7.69	2400	NIL	634.4	411.22	52	100	0.06	2	150	40	12.16	500	3.95	1560
LADHASAR	28.1456	74.6297	26	7.6	3600	NIL	427	744.45	312	175	0.17	2.15	150	24	21.888	790	3.93	2340
BHOJASAR	27.9722	74.5417	28	7.73	4050	Nil	329	950	178	32	0.02	4.50	900	92	162.944	510	45	2633
KANWARI	27.9167	74.6833	29	8.01	5540	Nil	891	319	439	1500	0.01	13.80	320	32	58.368	1170	16.7	3601
LOHA	28.0083	74.6153	28	7.63	620	Nil	268	28	10	42	0.02	2.40	130	20	19.456	66	30	403
Perihara	27.9244	74.5611	26	7.41	2920	Nil	1037	440	15	21	10.4	1.00	460	96	53.504	460	49	1898
RAJALDESAR	28.0375	74.4764	28	7.86	2333	Nil	293	525	150	100	9.08	1.20	440	68	65.664	340	48	1516
Sangasar	28	74.6567	30	8.04	1280	Nil	451	156	45	31	0.28	4.50	290	32	51.072	166	19	832
BHOJRASAR	28.545164	74.442928	28	7.55	7170	NIL	342	1609	960	19	0.009	0.06	880	136	131	1251	6.2	4661
MALSAR	28.578656	74.357356	31	7.76	1820	NIL	244	269	260	71	0.011	0.74	300	48	44	280	3.5	1183
MALKASAR	28.554195	74.302455	31	7.77	1500	NIL	366	227	115	11	0.014	0.02	210	44	24	248	4.6	975
RAJASAR PANWARAN	28.6189	74.230565	30	7.21	3100	NIL	293	603	297	220	0.02	0.97	410	76	54	535	5.70	2015
JAITASAR	28.784967	74.3252	28	7.55	2310	NIL	329	425	253	74	0.01	0.55	320	104	15	400	4.86	1502
SADASAR	28.702414	74.361499	31	7.82	2460	NIL	378	425	287	40	0.03	1.25	140	40	10	506	3.96	1599
BHANIPURA	28.623715	74.37002	30	7.53	5200	NIL	305	1276	519	60	0.01	1.65	460	80	63	1000	8.60	3380
BHOJOOSAR UPADHIYAN	28.304548	74.361328	30	7.42	850	NIL	317	85	34	20	0.01	0.67	190	40	22	110	4.30	553

PATLISAR CHOTTA	28.292596	74.393478	30	7.81	2450	NIL	366	475	224	36.0	0.01	0.90	400	112	29	380	7.80	1593
DHANI DEGAN	28.272617	74.491396	30	7.84	2765	NIL	671	340	268	150	0.01	0.81	210	36	29	560	4.65	1797
SAWAI BADI	28.395877	74.425422	31	7.70	1810	NIL	464	298	82	22	0.01	0.83	290	76	24	280	6.07	1177
RAJASAR BHEEKAN	28.394489	74.300396	31	7.89	3080	NIL	342	518	428	15	0.01	1.70	270	68	24	550	6.37	2002
GHADSISAR	28.411891	74.207346	28	7.80	4950	NIL	573	993	635	13	0.01	1.75	580	80	92	900	8.56	3218
ADSISAR	28.406246	74.125261	31	7.85	5320	NIL	537	808	661	650	0.02	1.60	820	96	141	900	16.8	3458
SOMASAR	28.389675	74.068772	30	7.93	5740	NIL	854	936	868	36	0.01	1.49	620	48	122	1070	9.00	3731
KANWALASAR	28.431148	74.113595	28	7.93	4477	NIL	525	922	543	16	0.03	1.98	500	72	78	830	8.50	2910
KARANSAR	28.460831	74.219782	29	7.99	5530	NIL	488	1177	716	75	0.01	1.35	620	64	112	1030	9.34	3595
POONUSAR	28.469469	74.281766	29	7.89	4150	NIL	537	709	664	19	0.01	1.80	660	72	117	680	11.50	2698
RAMSISAR BHEDWALIYA	28.468158	74.345972	28	7.76	1820	NIL	476	206	89	190	0.03	1.60	220	36	32	325	3.60	1183
DHANI PANCHERAN	28.504307	74.539244	31	7.71	14840	NIL	488	4041	1862	80	0.01	0.57	1680	360	190	2950	11.5	9646
DHANI DOODGIRI	28.615243	74.612796	31	7.62	8760	NIL	390	2269	579	500	0.01	1.68	1100	320	73	1560	32.0	5694
KHEJRA	28.621904	74.521385	31	7.55	11700	NIL	451	3049	1256	75	0.01	1.25	1240	100	241	2200	16.0	7605
SHIMLA	28.688301	74.568619	29	7.65	7120	NIL	537	1531	784	360	0.01	1.20	1020	220	114	1210	47.5	4628
BOGHERA	28.714628	74.603404	30	7.64	8330	NIL	378	2340	750	235	2	1.4	1900	260	304	1220	36	5415
MEHRASAR UPADHIYAN	28.797337	74.642565	30	7.58	6440	NIL	232	1879	615	5.8	0.75	0.75	1500	280	194.56	912	13	4186
UDSAR LODERA	28.457567	74.566329	31	7.54	8020	NIL	317	1552	820	1380	0.77	0.2	2600	380	401	835	13.2	5213
PULASAR	28.409389	74.610364	30	8.01	5690	NIL	488	1453	795	336	1.55	1.44	1100	140	182.4	1120	17	3699
UDASAR BIDAWATAN	28.373142	74.691153	30	7.9	4940	NIL	378	1134	1360	170	0.07	0.95	1400	180	231.04	951	14	3211
SARDARSHAHAR TOWN	28.443	74.501564	30	8.1	4080	NIL	805	603	865	476	3.1	1.42	600	60	109.44	1013	6.5	2652
GOPALPURA	27.7369	74.3756	29	7.09	6200	NIL	414.8	1730	587	100	0.06	0.38	990	236	97.28	1140	4.83	4030
KODASAR	27.7419	74.3061	26	7.56	2100	NIL	573.4	205.61	81	340	0.09	2.1	500	88	68.096	285	4.62	1365
SAROTHIYA	27.6706	74.2636	29	7.53	3050	NIL	451.4	531.75	104	420	0.07	0.78	760	164	85.12	370	5.01	1982.5
Karejra	27.5664	74.0792	25	7.64	2060	NIL	268.4	439.58	164	35	0.08	0.1	500	88	68.096	245	6	1339
LIKHMANSAR	27.5722	74.2192	29	7.58	3110	NIL	341.6	666.46	255.36	177	0.03	0.11	580	68	99.712	480	5.22	2021.5
TELAP	27.5458	74.1422	28	7.7	1190	NIL	390.4	127.62	87.36	25	0.09	0.52	230	44	29.184	174	4.14	773.5
MAGRASAR	27.4497	74.1733	29	7.12	8300	NIL	305	2382.2	724.8	27	0.01	2	1560	328	179.968	1300	5.7	5395
SUJANGARH TOWN	27.7067	74.4803	26	7.79	9200	NIL	1110.2	1786.7	815	950	0.05	38.5	460	56	77.824	2150	10.57	5980

JOGALIA	27.9297	74.4428	28	8.29	2100	NIL	207.4	354.5	242	300	0.13	4.8	660	112	92.416	235	6.05	1365
JAITASAR	27.9103	74.4189	27	7.46	3800	NIL	305	1035.1	174.24	75	0.01	0.66	800	136	111.872	520	19.23	2470
ABASAR PHANTA	27.8697	74.5097	28	7.68	12940	NIL	756.4	3970.4	1266	280	0	11.8	600	80	97.28	3300	18	8411
HARASAR	27.8697	74.5097	29	7.56	20560	NIL	573.4	6593.7	1774.6	600	0.02	17.6	2550	260	462.08	4400	27	13364
Rajiyasar meetha	27.8967	74.6303	28	7.6	4300	NIL	573.4	808.26	333	400	0.6	6.5	760	96	126.464	680	47	2795
KHURI	27.8358	74.6947	29	7.38	9500	NIL	475.8	1829.2	514	1800	0.05	0.95	2120	208	389.12	1250	96	6175
SOBHASAR	27.7597	74.7194	30	7.86	10050	NIL	1134.6	2339.7	402	800	0.02	5.4	750	80	133.76	2080	29	6532.5
KOLASAR	27.7519	74.6417	28	7.62	8690	NIL	963.8	1531.4	1188.5	950	1.41	7.8	820	64	160.512	1900	20	5648.5
MALSISAR	27.7497	74.5822	29	7.2	17000	NIL	561.2	4112.2	2445	1550	0.01	3.8	800	100	133.76	4250	23	11050
BARABAR	27.7814	74.5708	30	7.87	7750	NIL	915	1985.2	384	55	0.046	9.2	600	40	121.6	1550	39	5037.5
BOBASAR	27.7178	74.5447	29	7.7	9640	NIL	549	1169.9	1684	2350	0.095	10	2700	180	547.2	1100	535	6266
SALASAR	27.7233	74.7164	30	7.85	7960	NIL	1098	1843.4	696	110	0.074	9.6	450	60	72.96	1775	25	5174
BAMBOO	27.7333	74.1167	27	7.65	4110	Nil	207	1056	420	18	0.09	4.40	820	176	92.416	590	17	2672
SONIASAR	27.7736	74.0208	29	7.95	1820	Nil	415	255	186	95	0.16	0.72	140	32	14.592	375	14	1183
GULERIYA	27.7375	74.4186	26	7.16	2030	Nil	683	284	180	8.0	7.18	3.00	340	88	29	370	26.5	1320
TARANAGAR TOWN	28.687895	75.034195	28	8.17	2090	NIL	927	85	155	120.8	2.05	2	110	8	21.888	476.5	2.9	1359
CHANGOI	28.714784	75.110282	28	7.86	1990	NIL	415	362	35	115.4	5.1	1.48	300	24	58.368	319.5	2.6	1294
GOGATIYA CHARNAN	28.623918	75.046647	29	7.47	20000	NIL	207	6550	1190	78.8	2.12	1.45	3000	440	462.08	3550	16	13000
BHEEGRAN	28.553289	75.01693	30	7.96	19960	NIL	290	6350	602	780	6.3	1.3	3400	640	437.76	3250	17	12974
KHARATWAS	28.681907	74.973298	27	8.26	8620	NIL	281	2350	1650	732	1.05	1.05	2200	160	437.76	1686	6.1	5603
HADIYAL	28.491478	75.203914	27	7.64	10840	NIL	403	2694	1285	796	1	0.99	2000	240	340.48	1892	8.8	7046
TOGAWAS	28.572642	74.815136	28	7.58	10930	NIL	268	3049	1820	418	1.4	1.31	3100	320	559.36	1692	7.7	7105
PUNSISAR	28.822449	74.700357	30	7.68	2480	NIL	293	199	75	810	0.25	0.25	420	76	55.936	383.5	1.8	1612
RAIYA TUNDA	28.780836	74.799949	32	7.99	1500	NIL	708	85	4	60.4	0.25	0.22	190	20	34.048	199.5	102	975
KHICHI COLONY	28.661227	75.077137	28	7.33	7340	NIL	122	2127	760	76	0.05	0.05	1500	200	243.2	1128	6.8	4771
RAMPURA	28.4667	74.8625	Nm	7.88	9915	0	915	1489	1835	234	0.02	1.920	700	100	109	1953	11	6445
HARDESAR	28.6417	74.375	Nm	8.01	1520	0	317	170	242	10	0.00	0.286	180	24	29	262	12	988
BHOJASAR	27.9722	74.5417	Nm	7.86	900	0	256	106	79	8.2	0.00	0.529	180	32	24	119	12	585
SHAWA	28.875	74.8417	Nm	7.69	940	0	305	99	58	19	0.00	1.106	250	44	34	91	18	611
BHALAUTIBBA	28.7603	75.0272	Nm	7.84	945	0	298	50	90	76	0.00	0.055	260	32	44	89	16	614

MELUSAR1	28.2042	74.5306	Nm	7.9	3370	0	268	624	502	76	0.03	0.102	1040	160	155	261	63	2191
KHUNDIA	28.4139	74.2528	Nm	7.99	2240	0	494	269	226	121	0.00	0.380	200	24	34	419	8.2	1456
MEHRASAR	28.3572	74.5375	Nm	8.28	4400	0	329	794	645	165	0.01	1.709	280	22	55	881	4.6	2860
BINASAR	28.2625	74.875	Nm	7.79	8200	0	464	1418	1586	82	0.00	0.336	1100	160	170	1378	6.4	5330
DHIRAWAS	28.8417	74.9083	Nm	7.03	880	0	122	156	107	7.2	0.00	0.366	250	48	32	86	3.6	572
SADASAR	28.7	74.35	Nm	8.53	890	24	73	156	118	1.4	0.16	0.024	230	56	22	92	14	579
MITTASAR	28.4167	74.3836	Nm	7.98	2120	0	488	269	153	144	0.00	0.353	120	24	15	428	7.6	1378
SOMASAR	28.3861	74.0667	Nm	8.06	2310	0	549	297	186	112	0.00	0.568	180	36	22	446	7.1	1502
NANGLI	28.635	75.3	Nm	8.18	2515	0	622	326	226	62	0.96	0.130	540	64	92	327	7	1635
RAJGARH1	28.6333	75.375	Nm	7.82	2710	0	390	496	273	62	0.00	0.269	800	136	112	253	6	1762
Aspalsar	28.5769	74.5044	Nm	7.43	400	0	146	28	36	1.2	0.00	0.592	140	36	12	28	1.3	260
DADREWA	28.6694	75.2333	Nm	8.39	2580	120	439	184	377	90	0.04	1.396	200	48	19	500	4.2	1677
SIRSALA	28.4333	75.1306	Nm	8.41	2290	120	343	142	384	74	0.02	0.707	200	32	29	432	4.6	1489

ANNEXURE E: Post-Monsoon - Water Quality Parameters of Ground Water Samples of Churu District.

Block	Location	Lat.	Long.	Temp.	pH*	EC* µS/cm at 25°C	CO_3	HCO_3	Cl*	SO_4	NO_3*	PO_4	F*	TH*	Ca*	Mg*	Na*	K*	TDS
							mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
BIDASAR	PAREWARA	27.68	74.12	31	8.16	2600	NIL	232	567	240	41.2	0.04	0.87	610	140	63	303	5.1	1690
BIDASAR	INYARA	27.69	74.07	24	7.63	3210	NIL	268	674	920	28.2	0.02	1.45	1250	280	134	410.5	12.7	2087
BIDASAR	BADSHAR	27.58	73.91	28	7.82	8430	NIL	207	2482	410	44.6	0.25	2.2	2500	600	243	750	9.1	5480
BIDASAR	BADSHAR	27.58	73.91	28	8.02	1780	NIL	244	234	125	370	0.09	6.4	220	36	32	342	4.5	1157
BIDASAR	NODIYA	27.59	73.97	24	9.45	228.9	12	37	21	55	0.677	0.04	0.3	100	20	12	15.9	3.9	149
BIDASAR	DHADHERU	27.96	74.34	26	7.9	1190	NIL	159	191	207	52	0.033	1.72	330	72	36	151	5.6	774
CHURU	KARANPURA	28.41	75.07	24	8.24	9940	NIL	329	2836	230	440	0.21	0.75	980	160	141	1768	39.5	6461
CHURU	SAHJUSAR	28.38	74.97	25	7.82	3400	NIL	488	581	225	286	0.22	0.125	800	140	109	393	33.4	2210
CHURU	INDRAPURA	28.45	75.00	24	7.7	5000	NIL	500	1007	310	622.6	0.05	1.05	720	100	114	890	7	3250
CHURU	CHALKOI BANIROHATAN	28.52	74.97	26	7.75	11110	NIL	842	2907	950	210	0.55	2.05	960	120	161	2312	3.3	7222

CHURU	KOTWAD TAL	28.54	74.86	26	7.82	2210	NIL	244	397	60	296	0.1	0.92	240	64	19	378	5.6	1437
CHURU	KHANDWA PATTA	28.47	74.79	20	7.87	7260	NIL	293	2269	10	318	0.6	0.27	1520	168	268	1003	9.5	4719
CHURU	SOMASI	28.41	74.89	22	8.42	7190	60	744	1702		412	0.62	2.2	440	40	83	785	7	4674
CHURU	Khariya	28.30	74.88	26	7.29	13600	Nil	256	3120	2965	6.3	0.01	0.75	2650	300	462	2320	10.70	8840
CHURU	Balrasar athoona	28.35	74.79	21	7.92	3100	Nil	415	617	263	120	0.02	0.40	410	60	63	535	7.62	2015
CHURU	Nakrasar	28.29	74.73	23	7.82	5900	Nil	537	1248	608	280	0.02	2.00	490	52	88	1180	8.19	3835
CHURU	Satda	28.22	74.81	23	7.97	5500	Nil	451	1106	858	200	0.01	0.52	740	88	126	1030	6.94	3575
CHURU	Sahnali badi	28.19	74.86	22	7.68	6770	Nil	683	1219	1256	320	0.01	0.62	840	88	151	1380	6.95	4401
CHURU	Churu town	28.30	74.94	25	7.71	5720	Nil	659	1163	737	170	0.03	1.57	250	28	44	1300	11.38	3718
CHURU	Jasrasar	28.30	74.81	27	8.15	2800	Nil	378	319	491	400	0.01	0.20	610	76	102	450	5.60	1820
RAJGARH	Mangla	28.68	75.36	24	7.58	20600	Nil	415	6027	3085	110	0.02	0.98	2900	280	535	4250	4.85	13390
RAJGARH	Khuddi	28.72	75.30	22	8.28	1100	Nil	317	121	147	130	0.02	1.35	360	40	63	152	2.27	715
RAJGARH	Khuddi-3	28.72	75.30	24	8.12	2940	Nil	488	85	1110	260	0.01	0.85	320	40	54	720	2.62	1911
RAJGARH	Dhana	28.77	75.35	24	8.23	3990	Nil	586	865	95	210	0.02	2.25	190	20	34	820	2.14	2594
RAJGARH	Chainpura chotta	28.80	75.33	26	7.49	17310	Nil	549	5566	680	150	0.02	11.0	3650	400	644	2530	7.64	11252
RAJGARH	Sidmukh	28.89	75.29	24	7.48	4170	Nil	451	369	786	725	0.02	4.50	880	184	102	285	630	2711
RAJGARH	Tamba kheri	28.91	75.42	24	7.98	10200	Nil	573	2113	960	2300	0.01	2.30	2260	160	452	1860	6.70	6630
RAJGARH	Tamba kheri -3	28.91	75.42	25	7.40	5400	Nil	354	113	1128	1900	0.01	5.20	1640	256	243	700	8.54	3510
RAJGARH	Rejri	28.94	75.45	24	7.63	940	Nil	354	99	36	23	0.03	0.83	400	104	34	38	5.88	611
RAJGARH	Gugalwa	28.55	75.61	22	7.98	2140	Nil	439	298	222	220	0.01	2.35	150	28	19	480	1.90	1391
RAJGARH	Rampura beri	28.52	75.64	23	8.04	2090	Nil	512	312	182	75	0.01	1.30	190	40	22	424	2.95	1359
RAJGARH	Gagarwas	28.65	75.52	24	7.88	1370	Nil	207	227	167	80	0.02	0.48	230	52	24	228	3.92	891
RAJGARH	Thaan mathooi	28.63	75.45	23	7.86	9630	Nil	512	2588	1357	500	0.03	1.63	1450	100	292	2040	6.00	6260
RAJGARH	Lamba ki dhani	28.49	75.28	22	8.54	7170	72	805	1241	400	1450	0.04	2.05	850	60	170	1500	9.11	4661
RAJGARH	Sankhu	28.43	75.34	24	8.23	3750	Nil	634	298	473	900	0.06	4.40	340	64	44	840	4.00	2438
RAJGARH	Sulkhaniya bada	28.40	75.44	22	8.56	1240	96	293	106	160	28	0.01	5.70	110	16	17	295	4.00	806
RAJGARH	Sulkhaniya bada -3	28.40	75.44	23	7.71	340	Nil	110	43	26	7	0.01	0.27	140	48	5	19	2.72	221
RAJGARH	Seowa	28.64	75.16	23	7.52	19000	Nil	281	3793	2587	3600	0.01	4.30	4850	700	754	2150	1300	12350
RAJGARH	Harpalu	28.56	75.45	24	7.56	13000	Nil	720	2836	2792	700	0.02	1.05	2600	100	572	2500	25.40	8450
RAJGARH	Nima	28.47	75.48	26	8.01	2950	Nil	1086	220	280	140	0.04	13.60	140	12	27	690	1.63	1918

RAJGARH	Nima - 3	28.47	75.48	24	7.88	4300	Nil	988	588	602	190	0.04	3.20	340	32	63	960	2.47	2795
RAJGARH	DADREWA	28.67	75.24	26	8.08	8700	NIL	2477	680	1164	177	1.85	BDL	340	60	46	1844	4.4	5655
RATANGARH	BHOJASAR	27.97	74.54	26	8.48	4050	12	268	890	160	548	0.32	1.75	1040	136	170	477	28.1	2633
RATANGARH	KANWARI	27.92	74.68	26	8.47	5200	30	830	815	20	1200	0.11	7	380	40	68	1150	2.9	3380
RATANGARH	Perihara	27.92	74.56	21	9.18	5100	42	293	845	140	1255	0.52	2.65	560	48	107	956	34.5	3315
RATANGARH	Sangasar	28.00	74.66	28	8.59	3930	24	573	850	140	302	0.65	0.67	380	48	63	798	3.5	2555
RATANGARH	TIDIYASAR	28.07	74.75	26	7.39	7900	NIL	390	2340	272	396	0.22	0	1600	192	272	1206	8.2	5135
RATANGARH	BIRAMSAR1	28.04	74.79	28	7.67	4560	NIL	1135	638	602	88	0.65	1.8	430	64	66	965	4.1	2964
RATANGARH	GOLSAR	28.15	74.56	22	8.1	3400	NIL	305	766	408	87.5	0.32	0.12	190	36	24	757	3	2210
RATANGARH	LADHASAR	28.15	74.63	24	8.31	2690	24	403	518	190	18.7	0.22	3.35	110	28	10	556	2.6	1749
RATANGARH	Pabusar	28.22	74.50	24	7.74	2350	Nil	671	291	300	110	0.05	2.18	210	32	32	530	5.62	1528
RATANGARH	Hamoosar	28.18	74.46	24	8.24	2800	Nil	781	397	283	100	0.04	1.23	160	28	22	650	5.71	1820
RATANGARH	Bhanuda bidawatan	28.19	74.43	24	7.79	1670	Nil	439	225	170	115	0.01	1.00	200	44	22	340	10.6	1086
RATANGARH	Balrampura	28.13	74.42	26	7.86	1260	Nil	378	150	115	40	0.01	1.08	140	28	17	245	3.15	819
RATANGARH	Lachharsar	28.10	74.36	26	7.94	1550	Nil	317	274	166	30	0.01	0.45	370	72	46	215	6.65	1008
RATANGARH	Parsaneu	28.06	74.36	23	8.03	1380	Nil	366	217	120	33	0.01	0.88	180	36	22	265	4.00	897
RATANGARH	Alsar	27.99	74.34	22	8.11	1115	Nil	403	137	98	21	0.01	0.73	200	32	29	202	5.23	725
RATANGARH	RATANGARH	28.08	74.60	23	7.92	4000	NIL	695	651	415	94	1.80	BDL	870	136	129	519	5	2600
SARDARSHAHAR	Bhojrasar	28.55	74.44	26	7.56	6770	Nil	415	1744	1014	21	0.03	1.65	740	80	131	1440	6.64	4401
SARDARSHAHAR	Malkasar	28.55	74.30	24	7.57	1700	Nil	390	252	290	16	0.02	0.23	280	44	41	325	4.53	1105
SARDARSHAHAR	Rajasar panwaran	28.62	74.23	26	7.67	2990	Nil	281	585	433	48	0.01	0.53	400	68	56	525	5.11	1944
SARDARSHAHAR	Sawar	28.75	74.35	24	7.67	3700	Nil	244	510	1022	13	0.01	0.40	250	40	36	800	6.00	2405
SARDARSHAHAR	Sadasar	28.70	74.36	25	7.98	2150	Nil	403	372	300	48	0.01	0.85	140	24	19	490	3.59	1398
SARDARSHAHAR	BHANIPURA	28.62	74.37	24	7.37	3615	NIL	329	865	248	66	1.60	BDL	540	96	73	579	7.5	2350
SARDARSHAHAR	BHOJOOSAR UPADHIYAN	28.30	74.36	22	7.55	940	NIL	305	92	64	23	1.19	BDL	190	32	27	126	5.1	611
SARDARSHAHAR	PATLISAR CHOTTA	28.29	74.39	22	7.73	3130	NIL	342	453	590	36	0.17	BDL	800	112	126	348	8.5	2035
SARDARSHAHAR	DHANI DEGAN	28.27	74.49	26	7.8	2675	NIL	610	298	348	63	0.94	BDL	300	48	44	475	5.5	1739
SARDARSHAHAR	SAWAI BADI	28.40	74.43	22	7.89	1800	NIL	403	276	156	19	0.75	BDL	350	68	44	251	6.2	1170
SARDARSHAHAR	RAJASAR BHEEKAN	28.39	74.30	22	7.91	2640	NIL	390	362	450	17	2.71	BDL	330	52	49	453	5.5	1716

SARDARSHAHAR	GHADSISAR	28.41	74.21	25	7.79	4700	NIL	598	907	542	14	0.45	BDL	640	96	97	782	8.8	3055
SARDARSHAHAR	ADSISAR	28.41	74.13	26	7.63	3900	NIL	525	496	778	10	0.51	BDL	900	120	146	455	49.0	2535
SARDARSHAHAR	KANWALASAR	28.43	74.11	23	7.84	5480	NIL	390	860	927	295	1.55	BDL	520	80	78	1018	8.7	3562
SARDARSHAHAR	PAMPALIYA	28.40	74.11	24	8.09	6900	NIL	647	1092	1128	252	1.55	BDL	1140	200	155	1033	55	4485
SARDARSHAHAR	KARANSAR	28.46	74.22	24	8.19	6020	NIL	561	1122	804	153	1.32	BDL	800	104	131	1012	9	3913
SARDARSHAHAR	POONUSAR	28.47	74.28	23	7.83	4585	NIL	561	666	689	207	2.57	BDL	480	64	78	827	13	2980
SARDARSHAHAR	DHANI PANCHERAN	28.50	74.54	25	8.07	22300	NIL	281	6788	1280	1.632	0.25	BDL	2200	320	340	4117	14	14495
SARDARSHAHAR	DHANI DOODGIRI	28.62	74.61	24	7.89	7420	NIL	415	1610	1012	48	1.37	BDL	1100	168	165	1180	36	4823
SARDARSHAHAR	KHEJRA	28.62	74.52	23	7.87	6640	NIL	329	1237	1147	131	0.91	BDL	980	112	170	1067	17	4316
SARDARSHAHAR	SHIMLA	28.69	74.57	26	7.58	6490	NIL	464	1134	1028	231	1.98	BDL	2120	360	296	444	126	4219
SARDARSHAHAR	BOGHERA	28.71	74.60	24	7.34	6960	NIL	403	1007	1536	148	2.79	BDL	940	128	151	1149	34	4524
SARDARSHAHAR	MEHRASAR UPADHIYAN	28.80	74.64	26	7.88	5680	NIL	1242	596	912	35	1.08	BDL	420	76	56	1113	3	3692
SARDARSHAHAR	PULASAR	28.41	74.61	24	8.11	6140	NIL	195	1141	1094	198	0.11	BDL	880	120	141	998	19	3991
SARDARSHAHAR	UDASAR BIDAWATAN	28.37	74.69	24	7.84	4880	NIL	366	652	1070	130	0.05	BDL	540	96	73	865	16	3172
SARDARSHAHAR	SARDARSHAHAR TOWN	28.44	74.50	26	7.73	4580	NIL	830	567	558	273	2.83	BDL	480	72	73	830	7	2977
SARDARSHAHAR	UDSAR LODERA	28.46	74.57	27	7.53	8570	NIL	305	1240	512	2170	0.10	BDL	3050	440	473	562	16	5571
SUJANGARH	GOPALPURA	27.74	74.38	26	7.18	2420	NIL	512	432	270	129	0.02	0.9	410	116	29	467	2.6	1573
SUJANGARH	KODASAR - 1	27.74	74.31	26	7.4	1640	NIL	525	135	222	253	0.04	1.7	400	84	46	300.5	7.5	1066
SUJANGARH	KODASAR - 2	27.74	74.31	24	7.92	2600	NIL	305	610	166	143.5	0.05	1.5	610	84	97	362	7.2	1690
SUJANGARH	SAROTHIYA	27.67	74.26	27	6.06	2370	NIL	146	298	135	740	0.06	0.47	510	116	54	350.9	4.1	1541
SUJANGARH	MAGRASAR	27.45	74.17	24	7.88	6480	NIL	281	1808	670	29.31	0.32	1.45	1240	240	156	1040	6.3	4212
SUJANGARH	SUJANGARH TOWN	27.71	74.48	25	8.2	8610	NIL	1208	1914	505	744	0.33	15	480	88	63	1990	11.9	5597
SUJANGARH	JOGALIA	27.93	74.44	26	8.04	2540	NIL	122	603	90	316	0.02	0.82	740	112	112	256	6.3	1651
SUJANGARH	JAITASAR	27.91	74.42	25	7.78	4030	NIL	293	1134	170	56.5	0.31	0.65	920	168	122	519.5	11.9	2620
SUJANGARH	ABASAR PHANTA	27.87	74.51	28	7.89	13410	NIL	805	4183	490	263	0.92	6	500	80	73	3125	11.3	8717
SUJANGARH	HARASAR	27.87	74.51	21	7.54	19380	NIL	537	6097	1140	472	0.85	4.3	2240	216	413	3850	16.6	12597
SUJANGARH	Rajiyasar meetha	27.90	74.63	21	9.19	2340	36	427	383	450	107	0.03	6.2	280	24	54	561	22.7	1521
SUJANGARH	KHURI	27.84	74.69	22	8.96	5630	48	500	922	460	940	0.63	1.02	960	64	195	944	38.3	3660
SUJANGARH	KHURI - 1	27.84	74.69	25	7.55	5300	NIL	671	851	550	860	0.62	1.65	980	112	170	942	3.6	3445

SUJANGARH	SOBHASAR	27.76	74.72	25	7.7	10000	NIL	1135	2694	1320	837	0.8	5.7	800	60	158	2770	7.4	6500
SUJANGARH	MALSISAR	27.75	74.58	25	7.73	16370	NIL	561	4112	1550	1580	0.36	4	800	100	134	3850	13.4	10641
SUJANGARH	BOBASAR	27.72	74.54	15	7.96	8950	NIL	525	1064	850	2860	0.22	3.8	1660	152	311	1252	610	5818
SUJANGARH	SALASAR	27.72	74.72	26	7.88	6290	NIL	1110	1631	202	50.1	0.36	4.4	300	48	44	1456	5	4089
SUJANGARH	BAMBOO	27.73	74.12	27	7.45	3900	NIL	320	650	755	31.2	0.21	0.77	860	200	88	519	6.7	2535
SUJANGARH	BIDASAR	27.84	74.28	26	7.6	5450	NIL	256	1347	202	844	0.32	0.3	1900	312	272	506	6.4	3543
TARANAGAR	TARANAGAR TOWN	28.69	75.03	24	8.28	2330	NIL	695	156	298	72	2.14	BDL	200	32	29	442	3.6	1515
TARANAGAR	CHANGOI	28.71	75.11	24	7.21	20600	NIL	573	5382	1668	606	2.20	BDL	3500	480	558	3120	15	13390
TARANAGAR	GOGATIYA CHARNAN	28.62	75.05	25	7.52	25200	NIL	354	5808	3908	50	1.02	BDL	2000	320	291	4873	11	16380
TARANAGAR	BHEEGRAN	28.55	75.02	25	7.48	17000	NIL	659	3823	1438	1315	5.11	BDL	3200	560	437	2434	13	11050
TARANAGAR	KHARATWAS	28.68	74.97	24	7.81	12000	NIL	817	1702	1240	2028	1.04	BDL	900	100	158	2346	7.4	7800
TARANAGAR	HADIYAL	28.49	75.20	22	7.56	13620	NIL	403	2978	1878	400	1.08	BDL	2300	440	291	2070	13	8853
TARANAGAR	TOGAWAS	28.57	74.82	23	7.52	14800	NIL	281	2800	2880	264	2.26	BDL	3000	480	437	2020	10	9620
TARANAGAR	PUNSISAR	28.82	74.70	26	7.56	3590	NIL	256	624	388	366	0.59	BDL	920	160	126	396	11	2334
TARANAGAR	RAIYA TUNDA	28.78	74.80	24	8.28	4500	NIL	281	581	1076	79	5.87	BDL	240	40	34	925	1.5	2925
TARANAGAR	KHICHI COLONY	28.66	75.08	26	8.29	750	NIL	183	43	146	6.6	2.36	BDL	190	36	24	83	3.7	488

ANNEXURE F: Pre-Monsoon - Heavy Metal and Uranium Concentration in Ground Water Samples ofChuru District.

Block	Village	Lat.	Long.	Temp.	Cu	Mn	Ni	Pb	Zn	Fe	U IN PPB
					mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	PPB
BIDASAR	LUHARA	27.7081	74.2411	28	0.013	0.132	0.02	0.01	0.044	0.98	20
BIDASAR	PARAWA	27.6556	74.2133	28	BDL	BDL	0.011	0.003	BDL	BDL	24
BIDASAR	PAREWARA	27.6778	74.1197	28	BDL	BDL	0.018	0.003	0.161	0.193	19.58
BIDASAR	INYARA	27.6856	74.0683	29	0.057	0.143	0.02	0.01	0.127	1.802	26
BIDASAR	BADSHAR	27.5842	73.9072	28	0.025	0.028	0.02	0.01	0.075	2.2	27
BIDASAR	BADSHAR	27.5844	73.9078	28	0.013	BDL	0.015	BDL	0.036	0.173	27.8
BIDASAR	NODIYA	27.5928	73.9736	27	0.013	BDL	BDL	0.01	0.035	0.217	27.23

BIDASAR	KALERAN KI DHANI	27.8956	74.3042	30	0.013	BDL	0.02	0.01	0.141	0.183	58
BIDASAR	DHADHERU	27.9625	74.3408	30	0.013	BDL	BDL	BDL	0.026	0.19	20
CHURU	RANASAR	28.28121	75.08535	31	0.004	BDL	BDL	BDL	BDL	BDL	15
CHURU	KARANPURA	28.40552	75.07127	27	0.008	0.05	0.02	BDL	BDL	BDL	12.3
CHURU	SAHJUSAR	28.38077	74.9705	30	0.004	0.02	BDL	BDL	BDL	BDL	14.2
CHURU	INDRAPURA	28.45192	74.99612	29	0.004	BDL	BDL	BDL	BDL	BDL	48
CHURU	CHALKOI BANIROHATAN	28.5181	74.96901	28	0.013	0.04	0.02	BDL	BDL	BDL	112
CHURU	KOTWAD TAL	28.54384	74.85821	30	0.013	0.03	0.02	BDL	BDL	BDL	98
CHURU	KHANDWA PATTA	28.46547	74.78939	28	0.008	0.03	0.015	BDL	BDL	BDL	42
CHURU	SOMASI	28.40957	74.89202	29	0.004	BDL	BDL	BDL	BDL	BDL	32
CHURU	KHARIYA	28.30068	74.87805	29	0.017	0.05	0.02	BDL	0.113	0.108	25
CHURU	BALRASAR ATHOONA	28.34572	74.78534	30	0.004	BDL	BDL	BDL	BDL	BDL	25
CHURU	NAKRASAR	28.2894	74.73418	30	0.008	0.03	0.02	BDL	BDL	BDL	42
CHURU	SATDA	28.21503	74.8064	28	0.004	0.03	0.02	BDL	BDL	BDL	31
CHURU	SAHNALI BADI	28.18601	74.86414	28	0.004	0.03	0.018	BDL	BDL	BDL	28
CHURU	JASRASAR	28.29984	74.80799	28	0.004	0.03	BDL	BDL	0.035	0.062	27
RAJGARH	MANGLA	28.67889	75.36	28	0.042	0.11	0.02	BDL	0.028	BDL	65
RAJGARH	KHUDDI	28.72472	75.30111	28	BDL	BDL	BDL	BDL	BDL	BDL	27
RAJGARH	DHANA	28.76833	75.35417	28	BDL	0.03	0.015	BDL	0.048	BDL	11
RAJGARH	SIDMUKH	28.88766	75.28789	27	0.004	0.03	0.012	BDL	BDL	BDL	6.2
RAJGARH	TAMBA KHERI	28.90961	75.4211	29	0.008	0.05	0.02	BDL	0.058	BDL	65
RAJGARH	REJRI	28.94117	75.45266	29	0.004	0.03	0.018	BDL	BDL	0.06	24
RAJGARH	GUGALWA	28.54641	75.60826	28	0.004	0.02	BDL	BDL	BDL	BDL	26
RAJGARH	GAGARWAS	28.65442	75.51809	29	0.013	0.02	BDL	BDL	0.031	0.128	28
RAJGARH	THAAN MATHOOI	28.63277	75.44926	29	0.013	0.04	0.012	BDL	BDL	BDL	65
RAJGARH	LAMBA KI DHANI	28.48655	75.27909	30	0.004	0.022	0.02	BDL	BDL	BDL	90
RAJGARH	SANKHU	28.42958	75.34317	29	0.004	BDL	0.018	BDL	BDL	BDL	100
RAJGARH	SULKHANIYA BADA	28.39988	75.4368	30	0.004	BDL	0.012	BDL	BDL	BDL	98
RAJGARH	SEOWA	28.63572	75.15573	30	0.04	0.011	0.02	BDL	0.026	0.069	24.1
RAJGARH	PABASI	28.6352	75.20242	28	0.008	BDL	0.012	BDL	BDL	BDL	1.2

RAJGARH	HARPALU	28.5574	75.4504	29	0.012	0.022	0.02	BDL	BDL	BDL	110
RAJGARH	NIMA	28.47268	75.48374	30	0.004	BDL	0.02	BDL	BDL	BDL	25
RAJGARH	DADREWA	28.66688	75.23545	29	0.0041	BDL	0.0108	0.0102	BDL	BDL	25.6
RATANGARH	RATANGARH TOWN	28.0771	74.5988	29	BDL	BDL	0.02	0.003	BDL	BDL	29
RATANGARH	MALASAR	28.2397	74.5782	28	BDL	BDL	0.02	BDL	BDL	BDL	29
RATANGARH	KANGAR	28.2133	74.637	27	BDL	BDL	0.018	BDL	BDL	BDL	28
RATANGARH	DAUSAR	28.1917	74.6817	29	BDL	BDL	0.018	0.003	BDL	BDL	27
RATANGARH	MELUSAR	28.2125	74.5683	29	BDL	BDL	BDL	BDL	BDL	BDL	26
RATANGARH	GOLSAR	28.1508	74.5617	27	BDL	BDL	BDL	BDL	BDL	BDL	130
RATANGARH	LADHASAR	28.1456	74.6297	26	BDL	BDL	0.015	0.003	BDL	BDL	19.84
RATANGARH	BHOJASAR	27.9722	74.5417	28	BDL	BDL	BDL	0.003	BDL	BDL	24.8
RATANGARH	KANWARI	27.9167	74.6833	29	BDL	BDL	BDL	0.003	BDL	BDL	125
RATANGARH	LOHA	28.0083	74.6153	28	BDL	BDL	BDL	0.003	BDL	BDL	22.3
RATANGARH	Perihara	27.9244	74.5611	26	BDL	BDL	BDL	0.003	BDL	BDL	8.9
RATANGARH	RAJALDESAR	28.0375	74.4764	28	BDL	BDL	BDL	0.003	BDL	BDL	17.7
RATANGARH	Sangasar	28	74.6567	30	0.005	BDL	BDL	0.003	BDL	BDL	20.1
RATANGARH	PABUSAR	28.21687	74.49723	31	0.004	BDL	0.015	BDL	BDL	BDL	100
RATANGARH	HAMOOSAR	28.18451	74.46499	29	0.004	BDL	0.012	BDL	BDL	BDL	85
RATANGARH	BHANUDA BIDAWATAN	28.19123	74.42646	31	0.004	0.011	0.018	BDL	BDL	BDL	11
RATANGARH	BALRAMPURA	28.12844	74.41554	30	0.004	BDL	BDL	BDL	BDL	BDL	26.4
RATANGARH	LACHHARSAR	28.10339	74.35792	26	0.004	BDL	0.012	BDL	BDL	BDL	12.2
RATANGARH	PARSANAEU	28.05682	74.36381	26	0.004	BDL	0.012	BDL	BDL	BDL	18.2
RATANGARH	ALSAR	27.99255	74.34368	31	0.004	BDL	0.012	BDL	BDL	BDL	10
SARDARSHAHAR	BHOJRASAR	28.54516	74.44293	28	0.008	0.022	0.02	BDL	BDL	BDL	14.2
SARDARSHAHAR	MALSAR	28.57866	74.35736	31	0.008	0.011	0.015	BDL	BDL	BDL	10
SARDARSHAHAR	MALKASAR	28.5542	74.30246	31	0.004	BDL	0.012	BDL	BDL	BDL	16
SARDARSHAHAR	RAJASAR PANWARAN	28.6189	74.23057	30	0.0022	BDL	0.0106	0.01	BDL	BDL	13
SARDARSHAHAR	JAITASAR	28.78497	74.3252	28	BDL	BDL	BDL	0.0083	BDL	BDL	14
SARDARSHAHAR	SADASAR	28.70241	74.3615	31	BDL	BDL	BDL	0.0083	BDL	BDL	19
SARDARSHAHAR	BHANIPURA	28.62372	74.37002	30	0.0022	BDL	0.01	0.01	BDL	BDL	18.2

SARDARSHAHAR	BHOJOOSAR UPADHIYAN	28.30455	74.36133	30	BDL	BDL	0.0128	0.01	0.0398	BDL	11
SARDARSHAHAR	PATLISAR CHOTTA	28.2926	74.39348	30	BDL	BDL	0.015	0.01	BDL	BDL	15
SARDARSHAHAR	DHANI DEGAN	28.27262	74.4914	30	BDL	BDL	0.0173	0.01	BDL	BDL	29
SARDARSHAHAR	SAWAI BADI	28.39588	74.42542	31	BDL	BDL	0.0128	0.0083	BDL	BDL	15
SARDARSHAHAR	RAJASAR BHEEKAN	28.39449	74.3004	31	0.0022	BDL	0.0128	0.0083	BDL	BDL	13.3
SARDARSHAHAR	GHADSISAR	28.41189	74.20735	28	0.0022	BDL	0.0106	0.0083	BDL	BDL	28.2
SARDARSHAHAR	ADSISAR	28.40625	74.12526	31	0.0022	BDL	0.0106	0.01	BDL	BDL	65
SARDARSHAHAR	SOMASAR	28.38968	74.06877	30	0.0022	BDL	0.015	0.0083	BDL	BDL	85
SARDARSHAHAR	KANWALASAR	28.43115	74.1136	28	0.0022	BDL	0.015	0.01	BDL	BDL	74
SARDARSHAHAR	KARANSAR	28.46083	74.21978	29	0.0022	BDL	0.01	0.01	BDL	BDL	55
SARDARSHAHAR	POONUSAR	28.46947	74.28177	29	0.0022	BDL	0.0173	0.01	BDL	BDL	60
SARDARSHAHAR	RAMSISAR BHEDWALIYA	28.46816	74.34597	28	0.004	BDL	0.0152	0.0094	BDL	BDL	33
SARDARSHAHAR	DHANI PANCHERAN	28.50431	74.53924	31	0.0128	BDL	0.02	0.01	BDL	BDL	78
SARDARSHAHAR	DHANI DOODGIRI	28.61524	74.6128	31	0.0057	BDL	0.01	0.01	BDL	BDL	28
SARDARSHAHAR	KHEJRA	28.6219	74.52139	31	0.0093	BDL	0.02	0.01	BDL	BDL	29
SARDARSHAHAR	SHIMLA	28.6883	74.56862	29	0.0057	BDL	0.0129	0.01	BDL	BDL	24
SARDARSHAHAR	BOGHERA	28.71463	74.6034	30	0.0057	BDL	0.0175	0.01	BDL	BDL	25
SARDARSHAHAR	MEHRASAR UPADHIYAN	28.79734	74.64257	30	0.0075	0.0171	0.0175	0.01	0.0225	0.1304	26
SARDARSHAHAR	UDSAR LODERA	28.45757	74.56633	31	0.0146	0.0131	0.02	0.01	0.0331	BDL	22.3
SARDARSHAHAR	PULASAR	28.40939	74.61036	30	0.004	0.0239	0.0175	0.01	BDL	BDL	26.3
SARDARSHAHAR	UDASAR BIDAWATAN	28.37314	74.69115	30	0.004	BDL	0.0175	0.0094	BDL	BDL	21
SARDARSHAHAR	SARDARSHAHAR TOWN	28.443	74.50156	30	0.004	BDL	0.0175	BDL	BDL	BDL	23.5
SUJANGARH	GOPALPURA	27.7369	74.3756	29	0.017	0.013	0.011	0.01	0.044	0.175	28
SUJANGARH	KODASAR	27.7419	74.3061	26	0.005	BDL	0.015	0.003	BDL	BDL	29
SUJANGARH	SAROTHIYA	27.6706	74.2636	29	0.053	0.02	0.02	0.01	0.086	0.3	38
SUJANGARH	Karejra	27.5664	74.0792	25	0.009	0.029	BDL	BDL	0.125	0.11	13.5
SUJANGARH	LIKHMANSAR	27.5722	74.2192	29	0.009	BDL	BDL	BDL	BDL	0.077	48
SUJANGARH	TELAP	27.5458	74.1422	28	0.005	0.02	BDL	BDL	0.058	0.195	24
SUJANGARH	MAGRASAR	27.4497	74.1733	29	0.017	BDL	0.02	0.01	BDL	0.082	45
SUJANGARH	SUJANGARH TOWN	27.7067	74.4803	26	0.009	BDL	0.02	0.003	BDL	BDL	406

SUJANGARH	JOGALIA	27.9297	74.4428	28	0.009	BDL	0.011	0.01	0.075	0.106	13
SUJANGARH	JAITASAR	27.9103	74.4189	27	0.013	BDL	0.017	0.01	0.028	0.177	7.9
SUJANGARH	ABASAR PHANTA	27.8697	74.5097	28	0.022	BDL	0.02	0.01	0.028	4.6	350
SUJANGARH	HARASAR	27.8697	74.5097	29	0.043	0.016	0.02	0.152	0.051	0.225	110
SUJANGARH	Rajiyasar meetha	27.8967	74.6303	28	0.009	0.048	0.014	0.01	0.151	0.106	95
SUJANGARH	KHURI	27.8358	74.6947	29	0.013	0.011	0.02	0.01	0.085	0.113	62
SUJANGARH	SOBHASAR	27.7597	74.7194	30	0.013	BDL	0.02	0.01	0.029	0.106	250
SUJANGARH	KOLASAR	27.7519	74.6417	28	0.009	0.019	0.02	0.01	0.022	0.135	210
SUJANGARH	MALSISAR	27.7497	74.5822	29	0.191	0.019	0.02	0.01	0.106	0.525	29
SUJANGARH	BARABAR	27.7814	74.5708	30	BDL	BDL	BDL	0.016	BDL	BDL	28
SUJANGARH	BOBASAR	27.7178	74.5447	29	0.022	BDL	0.02	0.01	0.033	0.086	24
SUJANGARH	SALASAR	27.7233	74.7164	30	BDL	BDL	BDL	0.016	BDL	BDL	110
SUJANGARH	BAMBOO	27.7333	74.1167	27	BDL	BDL	BDL	0.016	0.165	0.061	14.6
SUJANGARH	BIDASAR	27.8386	74.2833	28	BDL	BDL	BDL	0.016	0.026	BDL	14.3
SUJANGARH	SONIASAR	27.7736	74.0208	29	0.157	BDL	BDL	0.016	0.058	0.076	23.1
SUJANGARH	GULERIYA	27.7375	74.4186	26	0.03	BDL	BDL	0.003	BDL	BDL	24.7
TARANAGAR	TARANAGAR TOWN	28.6879	75.0342	28	0.004	BDL	0.0175	BDL	BDL	BDL	135
TARANAGAR	CHANGOI	28.71478	75.11028	28	0.0146	BDL	0.0129	0.0094	BDL	0.1044	28
TARANAGAR	GOGATIYA CHARNAN	28.62392	75.04665	29	0.0217	0.023	0.02	0.01	0.0538	0.1735	29
TARANAGAR	BHEEGRAN	28.55329	75.01693	30	0.0181	0.0122	0.02	0.01	0.904	0.0599	21.3
TARANAGAR	KHARATWAS	28.68191	74.9733	27	0.0096	0.0125	0.01	0.01	BDL	BDL	25.6
TARANAGAR	HADIYAL	28.49148	75.20391	27	0.0059	BDL	0.01	0.01	BDL	BDL	29
TARANAGAR	TOGAWAS	28.57264	74.81514	28	0.0132	BDL	0.01	0.01	BDL	BDL	24.8
TARANAGAR	PUNSISAR	28.82245	74.70036	30	0.0059	BDL	0.0153	0.0102	BDL	0.0599	18.2
TARANAGAR	RAIYA TUNDA	28.78084	74.79995	32	0.0023	BDL	BDL	0.0102	BDL	BDL	19.2
TARANAGAR	KHICHI COLONY	28.66123	75.07714	28	0.0059	0.0153	0.0108	0.01	0.0269	0.0623	12