केंद्रीय भूमि जल बोर्ड
जल संसाधन, नदी विकास और गंगा संरक्षण
विभाग, जल शक्ति मंत्रालय
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

HANUMANGARH DISTRICT, RAJASTHAN

पश्चिमी क्षेत्र, जयपुर
Western Region, Jaipur

A REPORT ON AQUIFER MAPPING AND GROUNDWATER MANAGEMENT PLAN HANUMANGARH DISTRICT,

RAJASTHAN (9579.45 sq.km)

AAP 2019-20

पश्चिमी क्षेत्र, जयपुर

Western Region, Jaipur

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AQUIFER MAPPING AND MANAGEMENT PLAN
HANUMANGARH, RAJASTHAN

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District at a Glance

SALIENT INFORMATION	**Hanumangarh District**	
Longitude	73°44'52.8" and 75°29'27.6" East	
Latitude	28°48'14.4" and 29°21'39.6" North	
Geographical Area sq.km	9929.3	
Population (2011)	1424228	
Climate	Aird, Extreem hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	305	
Mean Annual rainfall (mm)	309.0530612	
Highest annual rainfall (mm) with year	822(1997)	
Lowest annual rainfall (mm) with year	431.8(2002)	
Standard deviation (mm)	96.89905139	
Coefficient of Variation (%)	31.35353231	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	16	32.65306122
Normal (-25% to -50%)	6	12.24489796
Severe (-50% to -75%)	5	10.20408163
Most severe (-75% to -100%)	1	2.040816327
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-AlongGhaggar river	
	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	
Elevation (m amsl)	164. 1 to 239	
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age:Recent to Sub-recent	
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age:Quaternary	
	• Sand stone poorly cemented,with verigated clay Age:Tertiary	
Drainage & Hydrology		
Drainage **Basin/Sub-Basin**	Ghaggar	
Minor Irrigation Projects	Canal	

CCA <2000ha	
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	970380
Forest Area in ha.	19061
Net Sown Area in ha.	847293
Area sown more than once in ha.	645091
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat
Area under Irrigation (Net) in ha	833447
Surface Water	813175
Ground Water	19969
Other sources	303
Contribution of Surface Water %	97.56769177
Contribution of Ground Water %	2.432308233
Principal Crops	
Crop Type Wheat	2450113
Barley	7058
Gram	110432
Sarso	130265
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	24
SGWD	71
NAQUIM Key Wells	156
WATER LEVEL BEHAVIOUR	Pre Monsoon
	(May-2019
Water Level (m bgl)	1.35 -44.86
Water Level Trend (2010-2019)	Pre Monsoon

Average Trend (m/year)		1.44	
		Pre Monsoon	
Rise		(-14.45) -(-0.04)	
Fall		0.002 - 8.33	
AQUIFER DISPOSITION			
Number of Aquifers (Major)			
I		Alluvium	
II		Alluvium& Tertiary	
Status of GW Exploration		CGWB	GWD
		75	28
BASIC AQUIFER CHARACTERISTICS			
Type of Aquifer		Phreatic	Semi confined
Depth of Occurrence (mbgl)		50 -100	110 -200
Yield Potential			100- 1800
Specific Yield (Sy)		0.015	
Transmissivity (T)			
CHEMICAL QUALITY OF GROUND WATER			
Electrical ConductivityµS/cm at 25°C		240 - 41830	
pH		1.54 - 8.93	
Suitability for Drinking			
TDS	**Range**		
Fresh	0-3000	77.56	
Brackish	>-3000	22.43	
Hardness	**Range**		
Soft	0 – 75	1.28	
Moderately Hard	75 – 150	15.38	
Hard	150 – 300	27.56	
Very Hard	>300	56.41	
NO3 in mg/l>45 mg/l	permissible limit	28	
F in mg/l – 1 to 1.5 mg/l	Between DL & PL	13	
>1.5	> Permissible	12	

mg/l	limit				
Suitability for Irrigation					
EC					
Type of Water	**Classification**	% Samples	RSC(meq/L)	% Samples	
			< 1.25	84.51612903	
Low Saline< 250 mg/l	Excellent	1.290323	1.25 -2.0	1.935483871	
Medium Saline 250–750 mg/l	Good	29.03226	2.0 -2.5	1.935483871	
Highly Saline 750 –2250 mg/l	Permissible	29.67742	2.5-3.0	0.64516129	
Very Highly saline>2250 mg/l	Doubtful	39.35484	> 3.0	10.96774194	
Na%			SAR		

Water Class	**Range**	% Samples	Water class	Range	% samples
Excellent	< 20	16.12903	Water class		
Good	20 – 40	26.45161	Excellenet	< 10	80.64516
Medium	40 – 60	25.16129	Good	10 to 18	10.32258
Bad	60 – 80	21.93548	Medium	18 to 26	6.451613
Very Bad	> 80	10.32258	Bad	> 26	2.580645

GROUND WATER ISSUES	
1. Inland Salinity	Ground water salinity
Limited availablility of fresh GW	Limited availability of fresh water
	Water logging

	Ground water contamination			
3. Rainfall and Drought	Mild Droughts in 33% years			
	Normal Droughts in 12% years			
	Severe Drought in 10% years			
GROUND WATER RESOURCE & EXTRACTION				
Ground Water Recharge Worthy Area (Sq. Km.)	1278.5			
Total Annual Ground Water Recharge (mcm)	210.199235			
Natural discharge during non monsson season (mcm)	19.724639			
Net Annual Ground Water Availability (mcm)	190.474596			
Existing Gross Ground Water Draft for All uses(mcm)	124.010217			
Provision for domestic and industrial requirement supply to 2025(mcm)	10.9242			
Stage of Ground Water Development %	65.10590893			
Category	SAFE			
In-Storage Resource				
Total Area (Sq. km)	9929.3			
Dynamic Resource (mcm)	190.4746			
Utilizable Volume (mcm)				
Total In-storage Resource (mcm)	2350.0321			
Total Resource Dynamic + In-storage	3004.2078			
Sustainability Period in years with existing draft				
GROUND WATER RESOURCE ENHANCEMENT				
Area identified for Artificial Recharge & Conservation	1278.5			
Existing Structures constructed by State Govt.	160			
Anicut	0			
Diggy/ jalhoj	57			

Earthen Checkdam		1
Johad		34
Mini Percolation tank		5
Minor Irrigation Tank		0
Recharge Shaft		12
Sub Surface barrier		0
Talai (Talab)		23
Water Harvesting Structure		28
Traditional Ground water conservation structures (Tanka) capacity of 50000lit		26836.2
No DCB		882
Prior to intervention	Annual Extractable Ground Water (ham)	19047.4596
	Current annual gross ground water extraction for 'All Uses' (ham)	12401.0217
	Resource surplus (hem)	6646.4379
	Category	0
Geographical Area of Block (sq km)		9579.6
Potential Area (sq km)		1278.5
Saline area (sq km)		8301.1
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may betaken and used
% Availability of of Fresh ground water area		13.34606873
%Availability of of Saline ground water area		86.65393127
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerence crop		Block has large part of saline area and horticulture and salt tolerence crop may be sown
Total irrigated area(Sq km)		4110.46
% of Irrigated area		42.90847217
Increase in 10 % of total irrigated area(sq km)		4521.506
% of Irrigated area		47.19931939
Expected Benifites		
Post int	**Stage of GW Development**	65.10590893
	Current annual gross	16094.16

er ve nti on	**ground water extraction for 'All Uses' (ham)**	
	Stage after inervention	84.49504731
	Category	Semi Critical

A REPORT ON AQUIFER MAPPING AND GROUNDWATER MANAGEMENT PLAN HANUMANGARH DISTRICT, RAJASTHAN (9579.45 sq.km)

1.0 Introduction

1.1 Objectives

Water is an essential source of life on planet earth. Over the period of decade owing to outburst of population, urbanization, deforestation and climate change have played significet role to enhance the demand of water.Since western Rajasthan is part of The Great Thar desert and and have no major perinial river so irrigation and domestic water supply is being met through the ground water.
dependability on ground water
Various developmental activities over the years have adversely affected the groundwater regime in the state. There is a need for scientific planning in development of groundwater under different hydrogeological situation and to evolve effective management practices with involvement of community for better ground water governance. In view of sprouting challenges in the ground water sector in the state there is an urgent need for comprehensive and realistic information pertaining to various aspects of groundwater resource available in different hydrogeological setting through a process of systematic data collection, compilation, data generation, analysis and synthesis. Hence, aquifer mapping and management of the study area is the need of the hour.

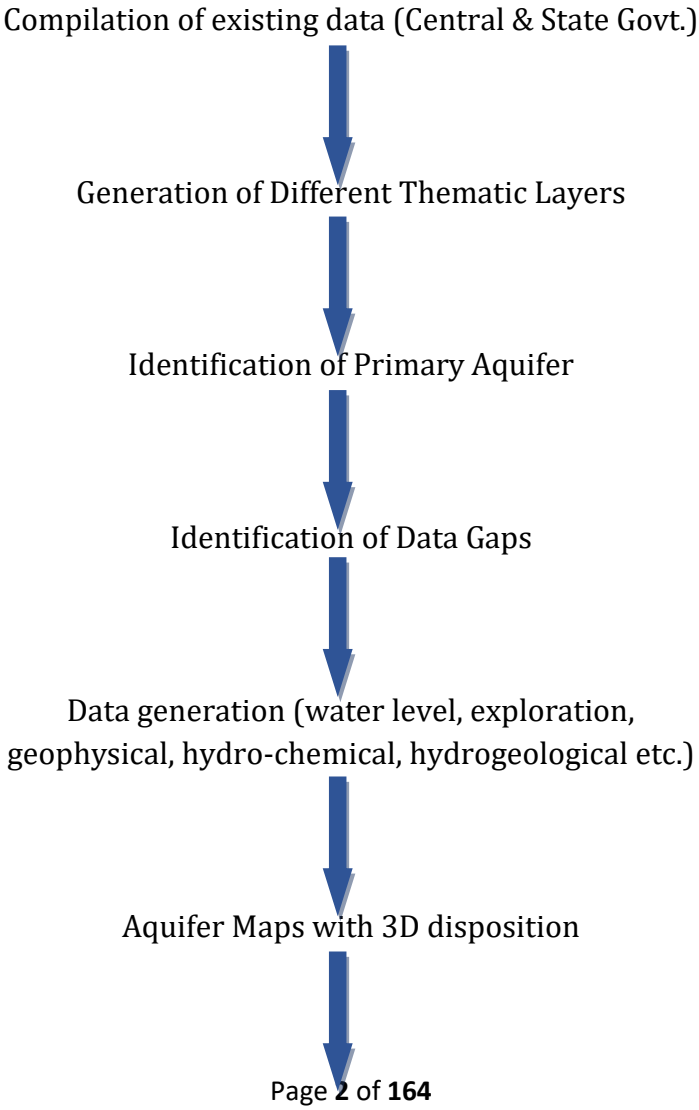
1.2 Scope of the study

Aquifer mapping can be understood as a scientific process wherein a combination of geological, geophysical, hydrological & chemical fields and laboratory analyses are applied to characterize the quantity, quality, and sustainability of ground water in aquifers. Aquifer mapping is expected to improve our understanding of the geological framework of aquifer, their hydrologic characteristics, water level in aquifer and how they change over time and space and the occurrence of natural and anthropogenic contaminants that affect the portability of groundwater. Results of these studies will contribute significantly to resource management tools such as long-term aquifer monitoring network and conceptual and quantitative regional groundwater flow models to be used by planners, policy makers and other stake holders. Aquifer mapping at appropriate scale can help to prepare, implement, and monitor the efficacy of various management interventions aimed at long term sustainability of our precious

groundwater recourses, which in turn will help to achieve drinking water scarcity, improved irrigation facilities and sustainability of water resource in the state.

1.3 Approach & Methodology

Aquifer mapping is an attempt to integrate the geological, geophysical, hydrological & chemical field and laboratory analyses and are applied to characterize the quality, quantity and sustainability of groundwater in aquifer. Underthe 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 in various aquifer system to facilitate planning of their suitable management. The major activities involved in this process encompass compilation of existing data, identification of data gaps, generation of data for feeling data gaps and preparation of different aquifer layers.



Preparation of Aquifer Management Plan

1.4 Study Area

Hanumangarh district located between latitudes 28o45'35'' and 29o57'25" N and longitudes 74o17'51" and 75o31'04" is the one of the northern most districts of Rajasthan. Occupying an area of around 9656.09 sq km, the district is surrounded by Churu and Sri Ganganagar districts of Rajasthan, Punjab and Haryana in the south, west, north and east respectively.

Previously Hanumangarh was known as Bhatner because it wasowned by Bhati King.On 1805 King Surat Singh concored the Bhatner fort on tusdey. As per Hindu mythology tusday is known as day of God Hanuman. Thereafter Bhatner was named as Hanumangarh.Besides archeological excavation of Kalibanga has placed to the hanumangarh on pride in prehistoric period and it is acclaimed as equivalent to Harapa civilization.

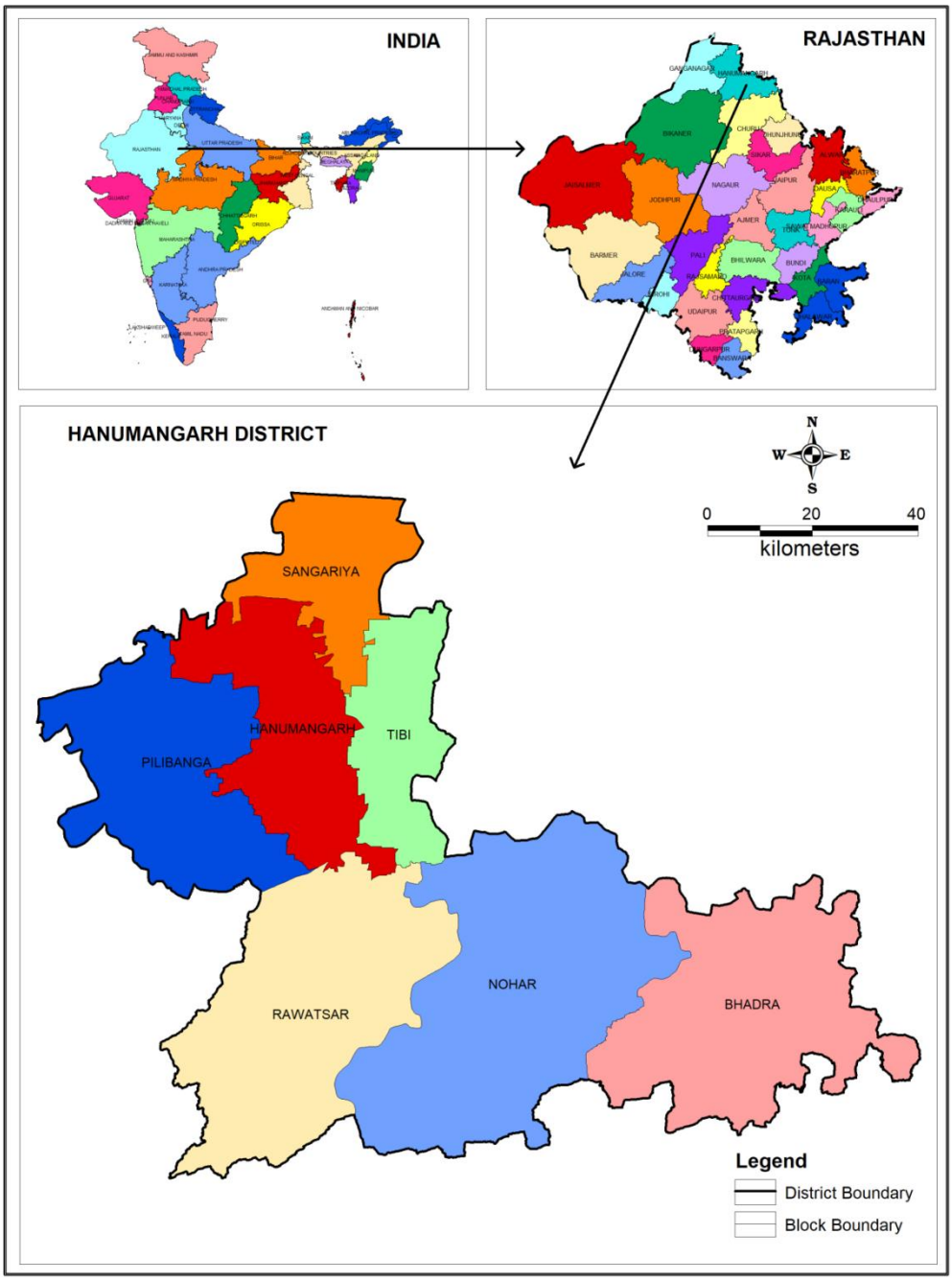


Figure 1.2.Administrative map of Hanumangarh District

For administrative convenience, the district is divided into 7 tehsils and development blocks viz. Bhadra, Hanumangarh, Nohar, Pilibanga, Rawatsar, Sangaria and Tibi Tehsils. It has a total population of 1774692 as per 2011 Census. The district has 1907 villages and 6 urban towns. Rural and urban population of the district is 14.29 lakh and 3.51 lakh respectively. Population wise data are presented in diagram below

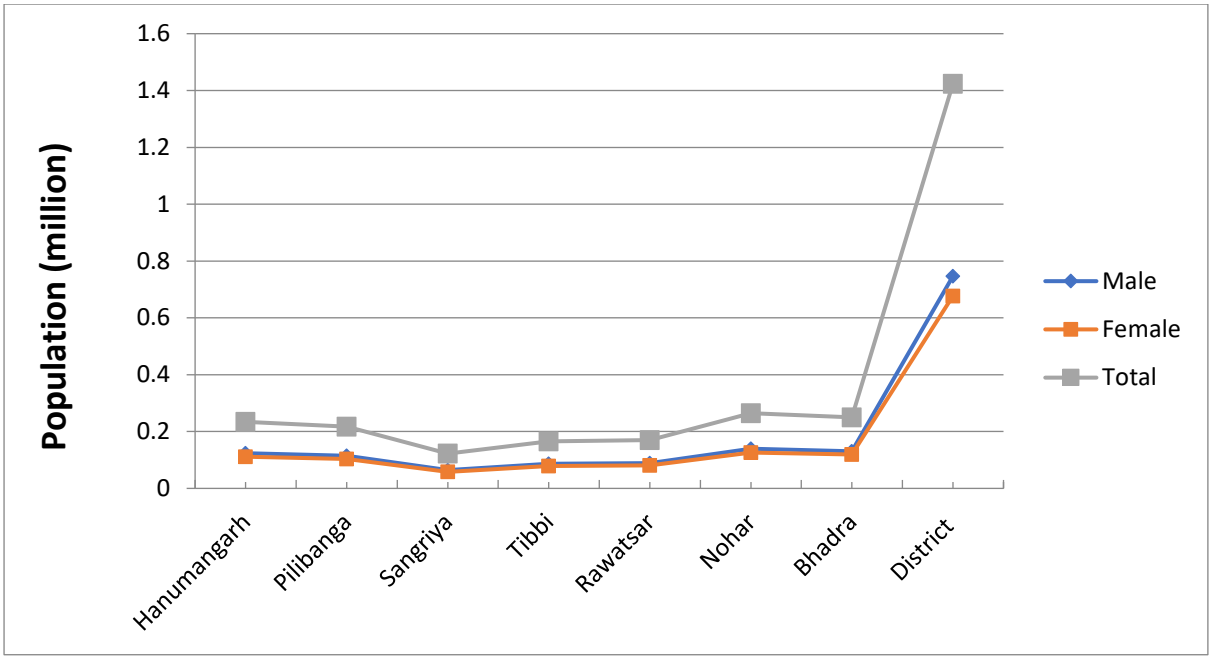


Figure 1.2.Population Graph of Hanumangarh District

Administrative map of the district showing block boundaries, block headquarters, physical features is presented as figure-1.1.

2.0 Climate and Rainfall

The climate of the district is semi-arid to arid except southwest monsoon season during the period June to mid of September, which is followed by post monsoon period till the end of November. The winter season is from December to February and is followed by summer from March to June. The mean daily maximum temperature varies from 20.5°C during January to 42.2°C during June while mean daily minimum temperature in the district varies from 4.7°C during January to 28.1°C during July.

2.1 Rainfall

The normal annual rainfall in the district is 309.05 mm. The long-term rainfall data (1970-2019) of the rain gauge stations located at all the block headquarters was subjected to various types of analysis to understand the characteristic of the rainfall. It was observed that the distribution of rainfall is quite uniform in the area except for Sangariya and Nohar Block. The rains usually start in the July and last till the end of September. The intensity of rainfall is the highest in August. On the basis of rain fall analysis it is observed that:

- On an average, the monsoon rainfall is 309.1 mm and. Of these, 25 days are during the monsoon months. Four to five days in June are rainy.
- Most of the rainfall is received (93.5%) during the monsoon months viz July to September.
- Precipitation during winter season is almost negligible.
- Highly deficient rainfall was recorded @ 67% during the year 2002 and deficit during the year 2007.
- The coefficient of variation in rainfall has been observed between 36.7 and 44.6.
- District is prone to mild and normal type of droughts. Probability of normalannualrainfall exceeding is only 53%.
- The long-term trend of rainfall was also calculated and declining trend was observed @ 0.09 mm/year.

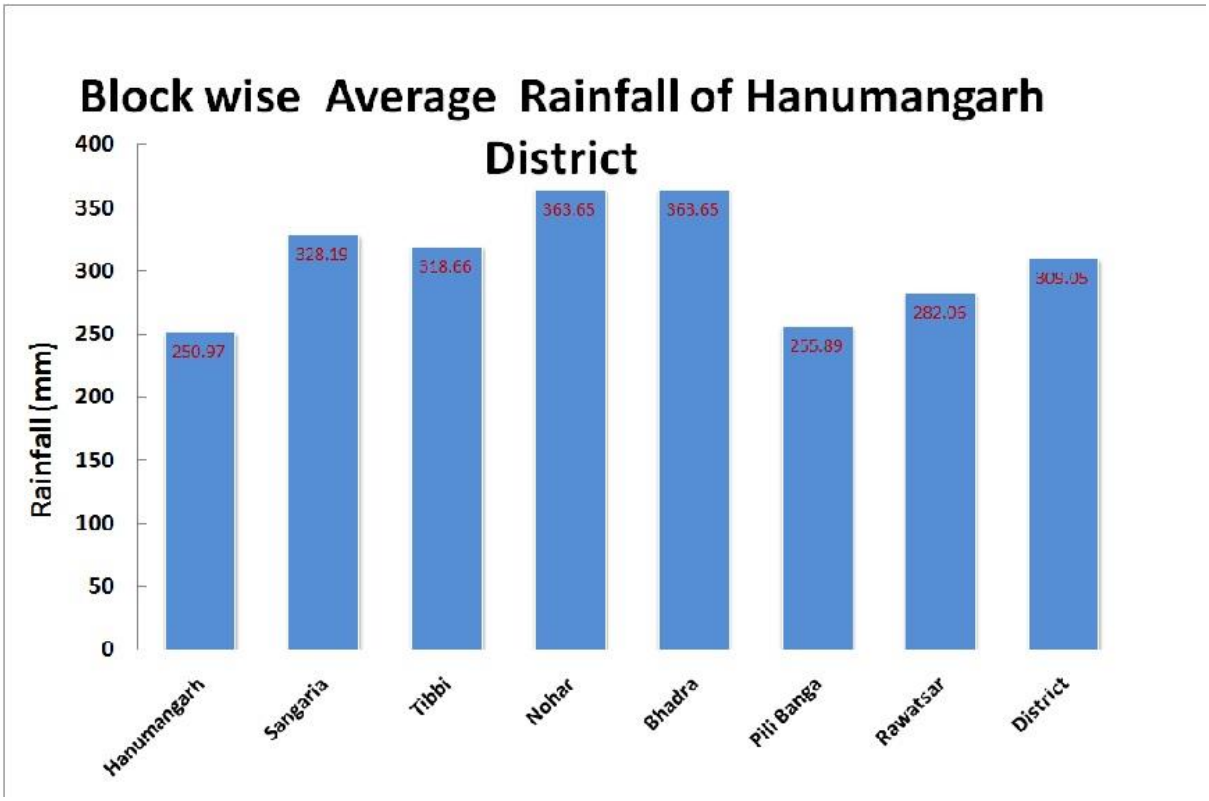


Figure 2.1: Spatial variation of Average Annual Rainfall in Hanumangarh District

2.1.2 Variability of Rainfall

Statistical Analysis of rainfall data shows that rainfall in the district is quite erratic (figure 2.4). The coefficient of variation shows that it varies from 36.7% at Rawatsar to 44.6% at Hanumangarh.. Block-wise details of analysis are presented in table 2.1.

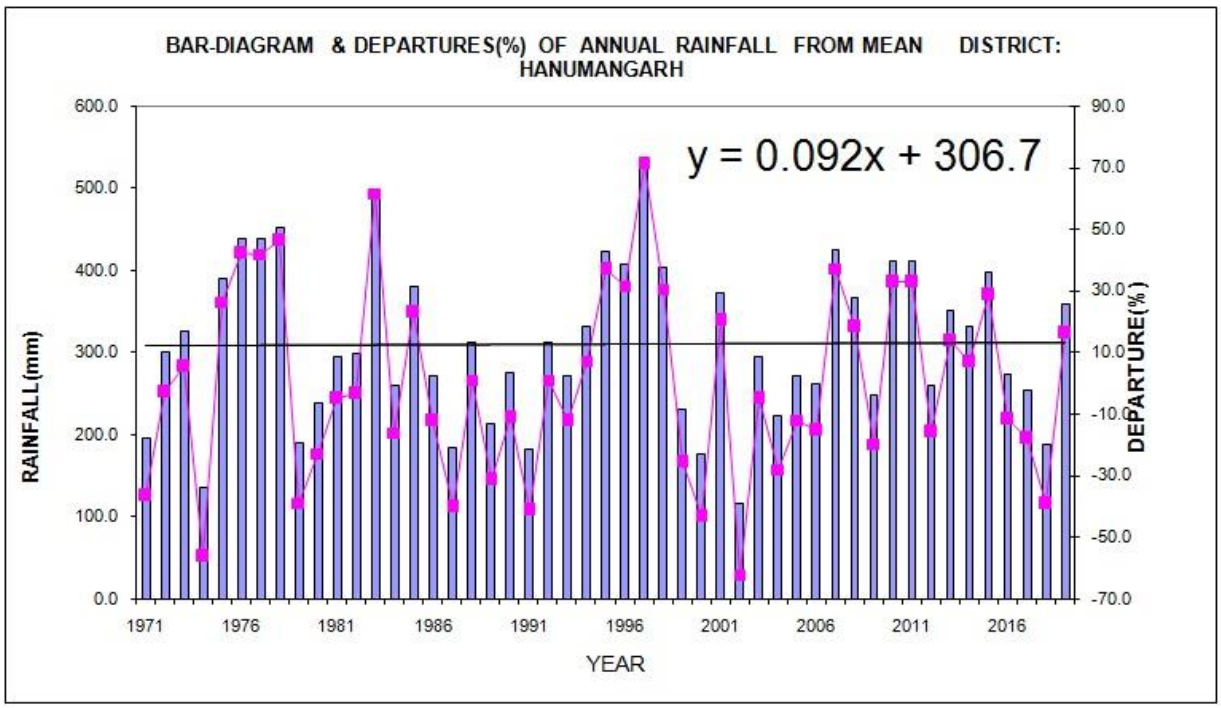


Figure 2.2: Average Annual Rainfall and its Departure Percentage in Hanumangarh District

Table2.1:Results of Statistical Analysis of Rainfall Data for the period 1970-2019

Particulars	Hanumangarh	Sangaria	Tibbi	Nohar	Bhadra	Pili Banga	Rawatsar	District
Mean Annual rainfall (mm)	251.0	328.2	318.7	363.6	#DIV/0!	255.9	282.1	309.1
Highest annual rainfall (mm) with year (mm)	547 (2010)	278 (2008)	626 (1997)	679 (1975)		394 (2013)	477 (2007)	822 (1997)

Lowest annual rainfall (mm) with year	75.5 (1974)	85 (1974)	105(1991)	106(2000)		67(2002)	109 (2002)	431.8 (2002)
Standard deviation (mm)	111.9	126.8	123.7	139.8	#DIV/0!	95.8	103.5	96.9
Coefficient of Variation (%)	44.6	38.6	38.8	38.4	#DIV/0!	37.4	36.7	31.4

2.1.4 Drought Analysis

Drought frequencies and years of occurrence of droughts have been computed using Agricultural Classification. It takes into account negative departure percentages of annual rainfall from mean annual rainfall. It is observed that almost whole of the area had experienced mild and normal droughts for 10 to 06% of years except for Tibbi Block which has experienced more years of mild droughts. Hanumangarh block and nohar lock have suffered with severe draft of 9 to 6 % of years respectively. (Table 2.3).

Table 2.2: Block-wise Rainfall Analysis of Drought and its Frequency

Drought analysis	**Hanumangarh**		**Sangaria**		**Tibbi**		**Nohar**		**Bhadra**		**Pili Banga**		**Rawatsar**		**District**	
	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %	No of Years	Frequency %
Mild	8	16.326531	10	20.408163	14	28.571486	11	22.44898			4	22.222222	6	33.333333	16	32.653061
Normal	6	12.244898	9	18.367369	10	20.408163	9	18.367347			3	16.666667		0	6	12.244898
Severe	9	18.367347	5	10.204081	4	8.163265	6	12.244898			2	11.111111	2	11.111111	5	10.204082
Most Severe	0	0		0											1	2.040816

3.0 Physiographic Set Up

3.1 Physiography

The district is a part of Thar Desert and is covered by thick layer of alluvium and wind blown sand. Generally sand dunes are 4 to 5 m in height. Regional elevation of ground ranges from 100 to 300 metres above mean sea level (masl). The district has a regional slope of less than 5 m/km. Geomorphologically, the land forms in the district can be divided into the various units as shown in Table:

Table 3.1: Physiographic set up of Hanumangarh District

Sr. No.	Origin	Land Forms	Occurrence in the District
1	Fluvial	Alluvial Plains	North of Ghaggar River
		Flood Plain	Along Ghaggar River
		Water Logged Area	Central part of the District
2	Aeolian	Sandy Plain	Scattered in northern and concentrated in southern part
		Aeolian plain	Scattered in central and southern parts
		Dune complex	Scattered along eastern and western margins
		Interdunal depression	Scattered in southeastern and southwestern parts
		Interdunal flat	Scattered in western, southwestern and southeastern parts

3.2 Geomorphology

The geomorphology map of Hanumangarh is presented in figure 3.1 and its details are tabulated in table 3.1.

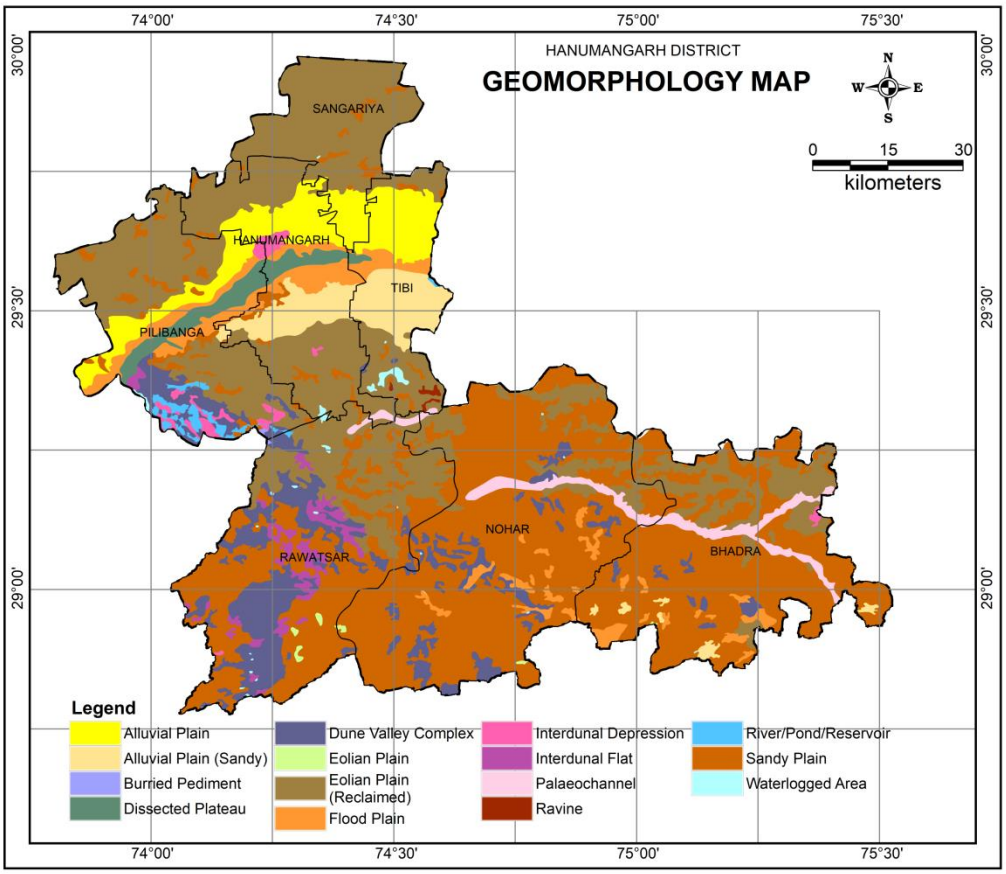


Figure 3.1. Geomorphology Map of Hanumangarh District

Table 3.2: Geomorphology of Hanumangarh District

Origin	Landform Units	Lithology/Material/ Description	Occurrence in the District	Land Use
Alluvial Origin	Alluvial Plain	Mainly undulating landscape developed due to fluvial activity, consists of gravels, sand, silt and clay. Terrain mainly undulating produced by extensive deposition of alluvium river system	Parts of Tibbi, Hanumangarh,Pilibanga	Double crop, single crop (Rabi/Kharif), fallow
	Flood Plain	The surface of smooth land, adjacent to river channel, formed by river and covered with water when river flow its bank. Normally subject to periodic flooding.	Northern Parts of Tibbi, Hanumangarh,Pilibanga Along Gagghar river	Double Crop (fertile land)
	Palaeo-channel	Mainly buried or abandoned stream/river courses, comprising of coarse textures material of variable size.	Eastern part of Bhadra, Nohar and northern part of Rawatsar block	Double Crop
	Water logged area	Gypsum and claymaterials	Tibbi and some part of Sangariya block	Marginal Double Crop, Single Crop (Rabi/Kharif)
	Ravine	Small, narrow, deep, depression smaller than gorges larger than gulley, usually carved by running water.	In tibbi block	Marginal Kharif Crop, Open Scrub
Aeolian Origin	Sandy Plain	Formed by aeolian activity, wind-blown sand with gentle sloping to undulating plain, comprising of coarse sand, fine sand silt and clay.	Southern part of Bhadra,Nohar and Rawatsar	Marginal Kharif Crop, fallow land with or without scrub
	Aeolian complex	It consists of various aeolinon land formofvarying size	Nohar Bhadra, Rawatsar	Marginal Kharif Crop, Open Scrub
	Dune complex	Dune perticullarly star dune and barchans	Rawatsar,Nohar,Pilianga	Marginal Kharif Crop, Open Scrub
	Interduanal depression	Area between to adjacent dunes	Rawatsar,Nohar,Pilianga	Marginal Kharif Crop, Open Scrub
Hills	Denudational Hills	Steep sided, relict hills undergone denudation comprising of varying lithology with joints fractures and lineaments	Pilianga and Rawatsar	Forest, Open Scrub

3.3 Land Use

Land Use

The socio-cultural and economic factors have significantly influenced over land use both in rural and urban areas in the district. Land forms, slope, soils and natural resources are some of the important which control the land use pattern of the district. The land use pattern of district is based on the statistical outline of the district 2019, published by Government of Rajasthan and is presented in Table 3.3 and figure 3.3

Table 3.3: Land Use Pattern of Hanumangarh District

S.No.	Land Use	Area in hectare
1	Total geographical area (as per village papers)	957945
2	Forest	19061
3	Net sown area	847293
4	Area Under Irrigation	833447
5	Area Under Irrigation(Surface Water)	813175
6	Area Under Irrigation(Ground Water)	19969
7	Area sown more than once	645091

Agriculture

Agriculture activity in the district is, by and large, confined to traditional kharif, Rabi and Zaid cultivation depending irrigation facilities. The major crops grown in the area are given in table no. 3.4 and season-wise crops are presented in table 3.5.

Table 3.4: Major crops of Hanumangarh District

Food Grain	Jowar, Bajra,Wheat, Barley, Maize, Rice
Cereals	Gram, other kharif cereals,Tur, other rabi cereals
Oil seeds	Rai & Mustard, Alsi
Non-food grains	Cotton, Onion, Red chilli, Tobacco, Potato, Jute,Opeum

Table 3.5: Season-wise crops Pattern of Hanumangarh District

Season	Crops covered
Kharif	Rice, Jowar, Bahra, Maize, Cotton, Tur, Seasum, Castor seed, Sugarcane, Soyabean and Ground Nut
Rabi	Wheat, Barley, Gram, Rape Seed Mustard, Taramira and Linseeed
Zaid	Jowar, Bajra, Gram, Urad, Moong, Moth, Chaula, Fruits and Vegetables, Tobacco, Small Millets, Spices and Fodder

Irrigation practices:

The northern part of the district is covered by arid soils which are characterized by alluvial soils. These soils are loamy in character. Central part of the district is characterized by entisols i.e. desert soils which are loamy along Ghaggar river course. Southern part of the district is characterized by arid soils i.e. non-calcic brown desert.

The main source of irrigation in the district is met out through surface water which is about to 98% of the total irrigated area where as irrigation through ground water is being carried out in the district particularly in the area where cannal water is not accessible and its contribution is merely 2% of total irrigated area. Merely Rawatsar and Pilibanga area the blocks where contribution of ground water is 10 % and 5% respectively.

Table 3.6: Details of Area irrigated with sources in Hanumangarh District

Sr. no	Source of Irrigation	Canal (Area in hect.)						Tube wells	Other source	Total irrigated area(hect)
1	Block	Rajasthan canal	Chambal Canal	Gang Canal	Bhakra Canal	Other sources	Total Irrigated through surface water (Area in hect.	(Area in hect.)	(Area in hect.)	(Area in hect.)
2	Hanumangarh	43467	0	0	144086	0	187553	0	0	187553
3	Pilibanga	32535	0	0	94924	0	127459	5859	0	133318
4	Sangriya	0	0	0	105972	0	105972	0	0	105972
5	Tibbi	29854	0	0	89530	0	119384	0	0	119384
6	Rawatsar	108873	0	0	0	0	108873	12149	0	121022
7	Nohar	6241	0	0	44401	32837	83479	0	35	83514

8	Bhadra	0	0	0	54483	25972	80455	1961	268	82684
9	District	220970	0	0	533396	58809	813175	19969	303	833447

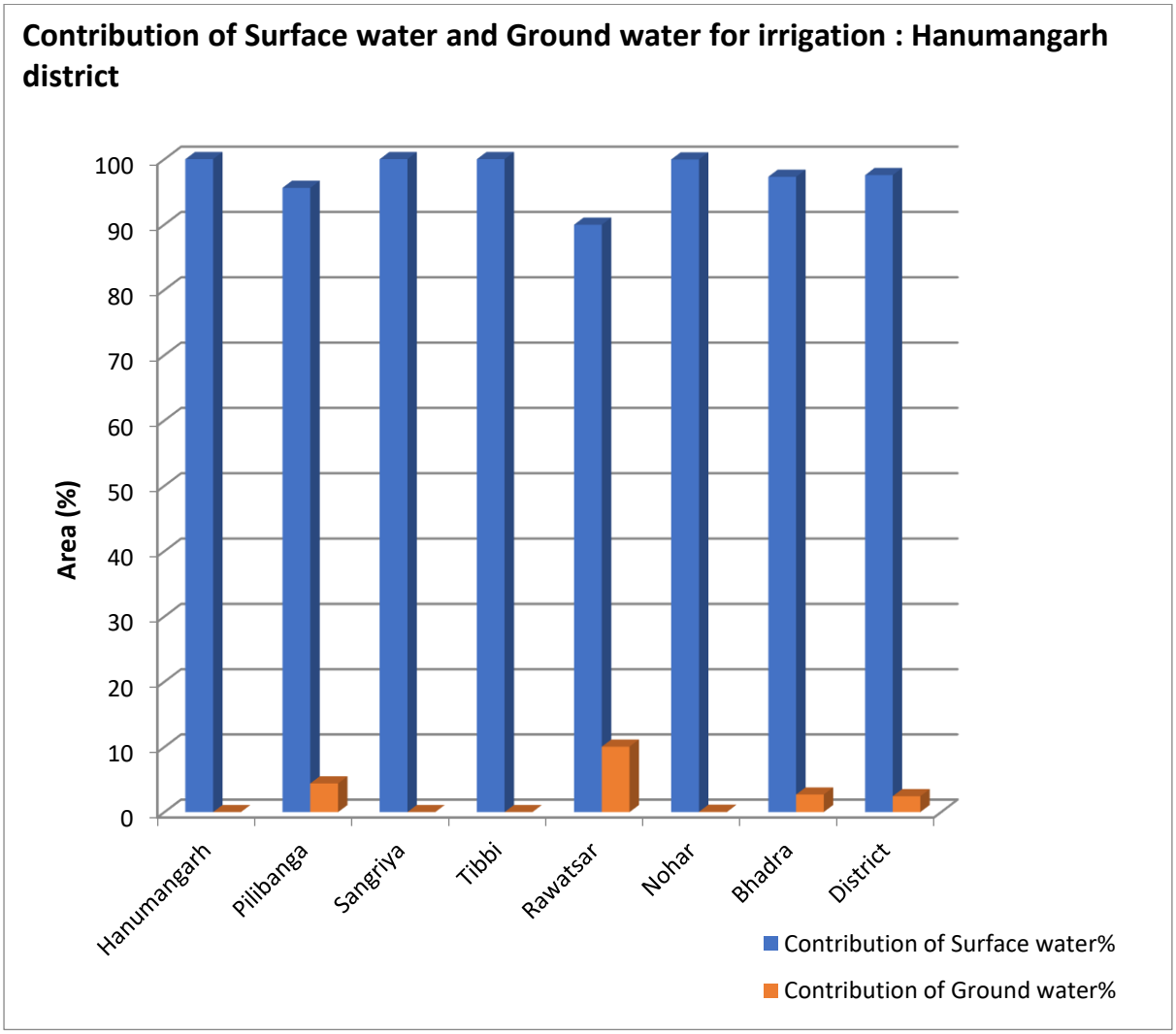


Figure 3.2. Use of surface & GW in irrigation,Hanumangarh District

Cropping Pattern

Net sown area is 801893 ha. and area sown more than once is 645091 ha in the district of which total irrigated area 833447 and gross irrigated area is 1492384.

Forest

The area under forests in the district is 190.61 sq. km. The forest covers an area of about 2 % of the total area of the district . Shrubs,Bambual Bambu, Neem, Peepal, Sisam etc. are the major trees of these forest. Major forest products are cooking wood, Charcoal, Tendu leaves, Guegal, Gum, Kattha, Honey etc. A part from these above products one special type of grass known as Khas is also available in abundance in these forests and is used to manufacture Itr & Perfumes etc.

3.4 Drainage and Hydrology

Ghaggar river, locally known as Nali, is the only marked surface water drainage, which flows from NE to SW. It is an ephemeral river which sometimes gets flooded during monsoon.

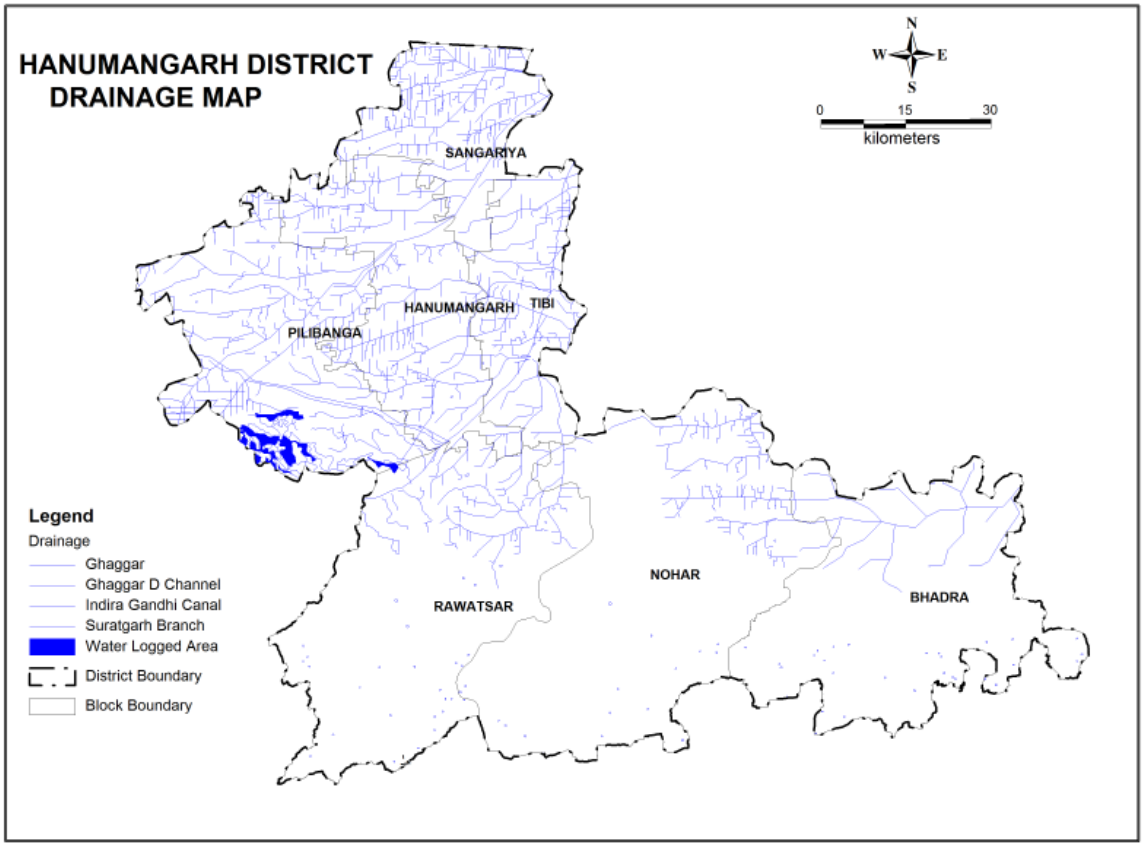


Figure3.3. Drainage Map of Hanumangarh District

Hydrology

The district is drained by canals of (1) Bhakra canal system, (2) Indira Gandhi Nahar Pariyojana and (3) Sidmukh canal system. Canal water is mainly used for irrigation and drinking purposes.

Bhakra canal system: Bhakra canal system utilizes water of Sutlej and Beas rivers. Rajasthan's share in Sutlej water is 2096 million cubic metres (mcm)/year. It provides irrigation to 372,000 hectares (ha) area through a total of 1,949 km of canal network. Branches of Bhakra canal irrigate northern parts of Hanumangarh district.

Indira Gandhi Nahar Pariyopjana: Indira Gandhi Nahar Pariyojana is a multi-disciplinary irrigation project conceived to use 10.69 billion cubic metres (bcm) of water available from Ravi and Beas rivers annually to cultivate 1087 million hectares (mha) of land in Thar desert of western Rajasthan.

Sidmukh Nohar Canal System: It is an irrigation project planned to provide irrigation in Nohar and Bhadra tehsils by utilizing Rajasthan's share in Ravi and Beas waters.

3.5 Soil

The northern part of the district is covered by arid soils which are characterized by alluvial soils. These soils are loamy in character. Central part of the district is characterized by entisols i.e. desert soils which are loamy along Ghaggar river course. Southern part of the district is characterized by arid soils i.e. non-calcic brown desert.

3.6 Prevailing Water Conservation and Recharge Practices

The State Government has constructed about 160 water conservation structures in the district and the details are presented in table 3.12 and their locations are shown in figure 3.7.

Table 3.12: Number of Rainwater harvesting/Conservation Structures constructed in Hanumangarh district by State Government Departments

Block	Anicut	Diggy/ jalhoj	Earthen Checkdam	Johad	Mini Percolation tank	Minor Irrigation Tank	Recharge Shaft	Sub Surface barrier	Talai (Talab)	Water Harvesting Structure	Total
Bhadra	0	7	0	6	0	0	0	0	2	0	15
Hanumangarh	0	8	0	0	0	0	6	0	0	0	14
Nohar	0	14	0	18	5	0	5	0	0	0	42
Pilibanga	0	10	0	3	0	0	1	0	2	0	16
Rawatsar	0	4	1	3	0	0	0	0	4	28	40

Sangaria	0	10	0	2	0	0	0	0	15	0	27
Tibbi	0	4	0	2	0	0	0	0	0	0	6
District	0	57	1	34	5	0	12	0	23	28	160

4.0 Hydrogeological Framework

4.1 Geology

The entire Hanumangarh district is covered by Quaternary Alluvium overlain by thin veneer of wind blown sand in the central part and by high dunes in the southern Part. In the northern part and in the Ghaggar flood plain, alluvium is without any blown sand cover. Quaternary alluvium is mostly fluvial in origin and consists of alternating sequence of sand, silt and clay. The thickness of alluvium varies from 100m in the southern part to over 400m in the northern part. The basement below alluvium consists of rocks belonging to Palana series and Nagaur group of Marwar Super group. Basement rocks consist of claystone, sand stone and basal evaporites sequence.

The geological succession of the district is given in table 4.1 and spatial distribution is shown in figure 4.1.

Table 4.1: Geological Succession of Hanumangarh District

Supergroup and Age	Group	Formation
Recent		Alluvium/Aeolion
Quaternary		Fluvial deposit
Tertiary	Sand stone with clay	Upper Bhander (Maihar) sandstone
Marwar Super group	Jodhpur Nagaur sand stone	Sand stone with clay

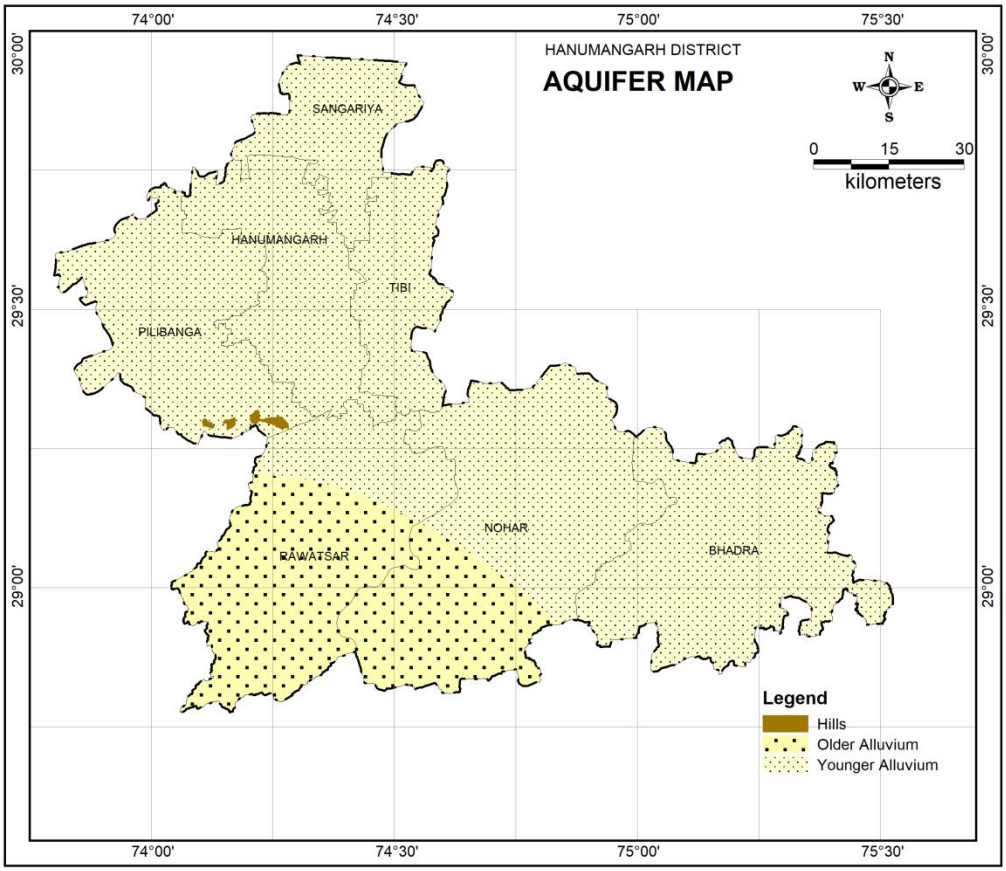


Figure 4.1. Geology of Hanumangarh District

4.2 Ground Water Exploration

A map depicting the hydrogeological features of the district is shown in Fig. 2. Hanumangarh district is divided into two units i.e. Younger Alluvium and older alluvium. Younger Alluvium covers maximum area of the district where as older alluvium occurs only in the southern part of the district. The ground water in the district occurs under water table condition but at a few places, it also occurs under semi-confined conditions due to presence of over lying impermeable clay horizons.

Younger Alluvium: It comprises of unconsolidated to loosely consolidated sediments of sand silt, clay and kankar. It forms the principal aquifer and all potential zones fall in this hydrogeological unit. Almost all tehsils have younger alluvial formation except Rawatsar.

Older Alluvium: It comprises of sandy and gypseous clay with kankar. It occurs in the southern parts of the district. The older alluvium does not contain any potential zone.

Aquifer Parameters: Based on groundwater exploration, transmissivity of the aquifer has been estimated to vary from 80 m2/day to 1600m2/day. Transmissivity and permeability values are higher around Ghaggar Flood plain area and decrease away

from it. Average yield of dug wells and dug-cum bore wells/ tube wells in younger alluvium is 20,000 and 3, 00,000 litres per day.

Central Ground Water Board and State Ground Water Department has drilled exploratory wells in the district in various formations to explore the formations lying underneath and to know the aquifer parameters. The block wise details of exploration carried out in the district are tabulated in table 4.2 and well wise details in Annexure III.

Table 4.2: Block-wise Details of Exploration in Hanumangarh District

Block	CGWB					GWD				
	EW	OW	SH	PZ	Total	EW	OW	SH	PZ	Total
Bhadra	4	1	0	0	5	0	4	0	1	5
Hanumangarh	12	0	6	2	20		8	0	6	14
Nohar	4	1	1	0	6	2	4	0	3	9
Pilibanga	14	2	2	0	18	0	0	0	0	0
Rawatsar	1	0	0	1	2	0	0	0	0	0
Sangaria	2	0	0	2	4	0	0	0	0	0
Tibi	12			2	14	0	0	0	0	0
District	49	4	9	7	69	2	16	0	10	28

Occurrence of Groundwater in Alluvium formation

Ground water occurs under unconfined to Semi- confined conditions Alluvial (alluvium of Quaternary age) which is tapped through various ground water abstraction structures viz. dug well, dug cum borewell and tube well.

Table 4.3: Block-wise Details of Exploration in Alluvium in Hanumangarh District

Block	Aquifer		Depth Drilled (m)	SWL(mbmp)	Discharge (lpm)	Draw down (m)	Transmisivity (m2/day)	Storage cofficient
Tibbi	Younger alluvium	Average	193.3107	12.40286	912.5	8.083333	1116	
		Min	141.2	3.33	400	4.08	1116	
		Max	256.4	21.85	1800	14.6	1116	
Sangariya	Younger alluvium	Average	150.3333	19.68667	375			
		Min	62	16.3	200			
		Max	200	24.46	550			
Rawatsar	Younger alluvium	Average	182	26	250			
		Min	182	26	250			
		Max	182	26	250			

Pilibanga	Younger alluvium	Average	180.0208	18.3575	459.25	4.015714	1486	0.0089
		Min	130	6.13	100	1.98	1392	0.0028
		Max	200	25.43	1000	4.25	1486	0.0089
Nohar	Younger alluvium	Average	143.8867	22.234	332.5			
		Min	97.3	16.16	100			
		Max	188.92	30.98	480			
Hanumangarh	Younger alluvium	Average	164.7163	17.79583	624.6957	5.92	747	0.007333
		Min	70.4	9.3	160	1.6	80	0.0025
		Max	201	31.93	1200	13.54	747	0.013
Bhadra	Younger alluvium	Average	131.16	14.332	480			
		Min	93.8	7.5	300			
		Max	150	19.6	700			
District	Younger alluvium	Average	171.7115	17.25172	614.8226	5.352273	1054.833	0.00796
		Min	0	3.33	30	1.6	80	0.0025
		Max	256.4	32	2000	14.6	1580	0.015

4.3 Ground Water Dynamics

Central Ground Water Board periodically monitors National Hydrograph Network Stations (NHS) stations in the Hanumangarh District, four times a year i.e. in January, May (Pre-monsoon), August and November (Post monsoon November. The monitoring wells of state GWD comprise 53 dug wells and 52 piezometers in the district. During field work carried out for NAQUIM studies 36 key wells were established in the area where there was a gap in water level data of previous years .. In total 141 wells were monitored during May 2019 to generate the water level scenario in the district. The Post monsoon scenario was generated with 141 wells which were monitored during November 2019 by CGWB and State Ground Water Department. The comparative block-wise details of wells analysed during both the seasons is tabulated in table 4.6 and well-wise details are presented in Annexure IV.

4.3.1 Water Level Behaviour

Table 4.4:Block-wise DTWL Ranges in Pre & Post monsoon 2019 in Hanumangarh District

Sr.No	Blocks	Aquifer	No of monitoring Station	Season	Ground water level ranges(m)						
					0 to 2	2 to 5	5 to 10	10 to 20	20 to 30	30 to 40	> 40
1	Bhadra	Younger	18	Pre Monsoon_20	0	1	2	15	0	0	0

		Alluvium		19							
				Post Monsoon_2019	1	0	2	15	0	0	0
2	Hanumangarh	Younger Alluvium	24	Pre Monsoon_2019	1	0	3	4	15	0	0
				Post Monsoon_2019	1	0	3	4	14	1	0
3	Pilibanga	Younger Alluvium	8	Pre Monsoon_2019	0	0	1	1	4	2	0
				Post Monsoon_2019	0	0	0	3	3	2	0
4	Nohar	Younger Alluvium	18	Pre Monsoon_2019	0	0	0	12	5	1	0
				Post Monsoon_2019	0	0	1	12	4	1	0
5	Rawatsar	Younger Alluvium	8	Pre Monsoon_2019	1	2	2	0	0	1	2
				Post Monsoon_2019	1	0	2	0	0	1	2
		Older Alluvium	7	Pre Monsoon_2019	0	0	1	0	1	2	3
				Post Monsoon_2019	0	0	1	0	1	2	3
6	Sangaria	Younger Alluvium	8	Pre Monsoon_2019	1	0	1	6	0	0	0
				Post Monsoon_2019	1	0	1	6	0	0	0
7	Tibbi	Younger Alluvium	5	Pre Monsoon_2019	0	2	0	2	0	1	0
				Post Monsoon_2019	1	0	2	0	0	1	0
8	District	Younger Alluvium	60	Pre Monsoon_2019	1	4	5	30	13	4	2
				Post Monsoon_2019	3	0	7	29	11	5	2
		Older Alluvium	7	Pre Monsoon_2019	0	0	1	0	1	2	3

				Post Monsoon_2019	0	0	1	0	1	2	3

Pre-monsoon (May 2020)

Depth to water level varied from 1.35 to 44.8 m during pre-monsoon, 2019 (figure 4.3). Deeper water level i.e. more than 20 m has been recorded in 24 observation wells lying in the south eastern and North western part of district.
However in central part of district show 2 to 5 m water level ranges.Remaining area has water level ranges 10 to 20 mbgl. In terms of area pre monsoon scenario is presented in table 4.7 and figure 4.4.

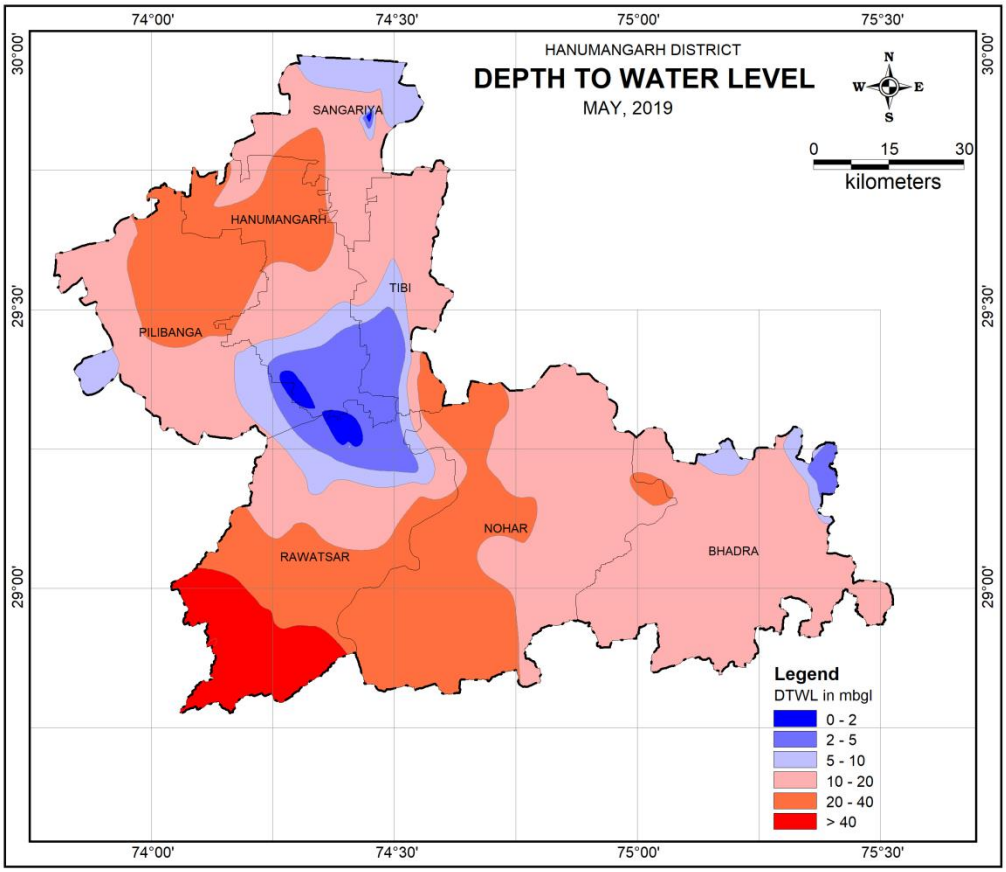


Figure 4.2: Depth to Water Level Map of May 2019 in Hanumangarh District.

Table 4.5: Block-wise Depth to water Level Ranges in May 2019 & Nov2019 in Hanumangarh District

Sr. No	Blocks	Aquifer	Depth ranges(m)			Pre monsoon WL (mbmp)			Post monsoon WL (mbmp)			flactuation WL (m)		
			Average depth	min	max	Average	min	max	Average	min	max	Average	min	max

1	Bhadra	Younger Alluvium	32.035	17.42	70	12.79389	3.22	18.15	12.59389	1.61	17.59	0.2	-0.28	1.61
2	Hanumangarh	Younger Alluvium	63.85083	20.5	198.9	19.48667	1.72	28.59	19.99417	1.16	31.46	-0.4625	-4.04	0.56
3	Pilibanga	Younger Alluvium	64.895	25	201	23.43875	9.53	30.07	23.74375	10.71	30.01	-0.305	-1.47	1.5
4	Nohar	Younger Alluvium	41.73889	18	180	17.74833	10.24	22.06	17.24	9.24	21.68	0.508333	-1.74	3.37
5	Rawatsar	Younger Alluvium	47.08625	19	127	18.24	1.35	42.14	18.03875	1.31	42.16	0.20125	-0.37	0.20125
		Older Alluvium	50.63143	38.3	62.35	33.80714	8.9	48.45	34.25286	8.96	48.92	-0.44571	-2.62	0.57
6	Sangaria	Younger Alluvium	54.465	18.25	200	12.64875	0.52	19.23	12.5925	0.3	18.62	0.05625	-0.48	0.61
7	Tibbi	Younger Alluvium	65.972	25.51	200	11.98	4.21	32.1	11.29	4.91	33.95	0.69	-1.85	4.62
8	**District**	**Younger Alluvium**	**43.03**	**15.00**	**200.00**	**17.40**	**1.35**	**44.86**	**17.35**	**1.31**	**43.61**	**0.05**	**-4.04**	**3.37**
		Older Alluvium	**50.63143**	**38.3**	**62.35**	**33.80714**	**8.9**	**48.45**	**34.25286**	**8.96**	**48.92**	**-0.44571**	**-2.62**	**0.57**

Post monsoon (November 2019)

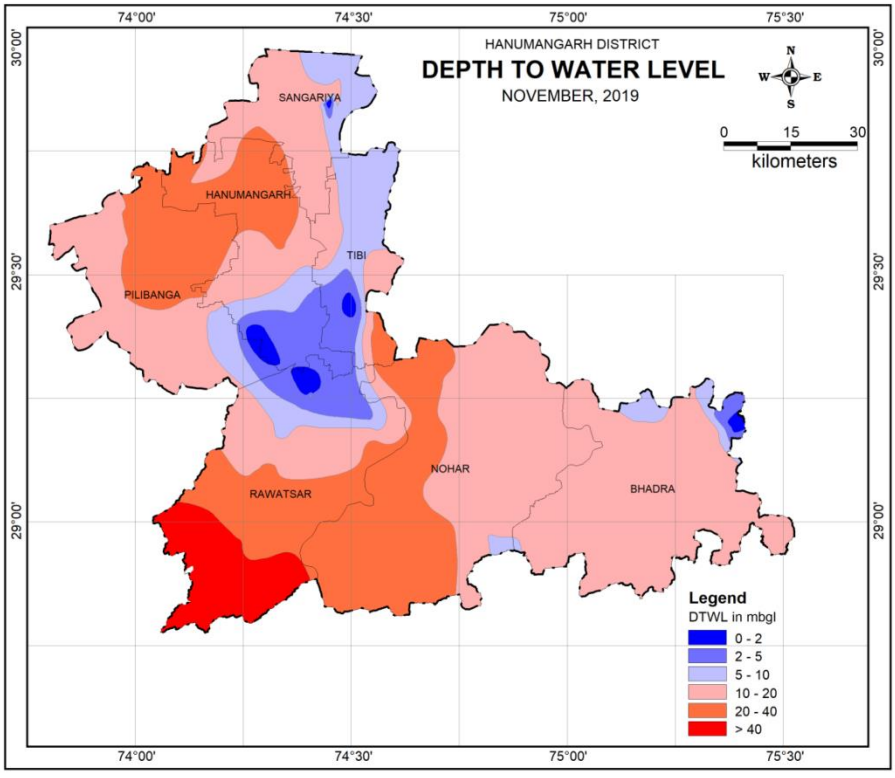


Figure 4.3: Depth to Water Level Map of November 2019 in Hanumangarh District

A total of 141 wells were analysed for post monsoon 2019 and depth to water level varied 0.29 to 48.92 m during the season (figure 4.5). The water level scenario divides the district in almost two parts vertically where the eastern half has deeperwater levels between 10 to 20 m in 34 wells (30.4%) and more than 20 m in 14 wells (13%) some of the localized areas and more than 40 m bgl in 2 wells one in the south-eastern part of the district

4.3.2 Ground Water flow

Water table contour map of May 2019 is presented in Figure 4.7. The perusal of the map shows that the water table elevation follows the reginal topography of the area and ground water flow direction is towards major drainage lines. Ground water flows towards the major river Gaghhar .Closely spaced contours on the western side of the map indicate ground water mound due to water logging and high rate of flow of ground water, while widely spaced contours in the other areas indicate gentle slope. General ground water flowdirection is NE to SW.

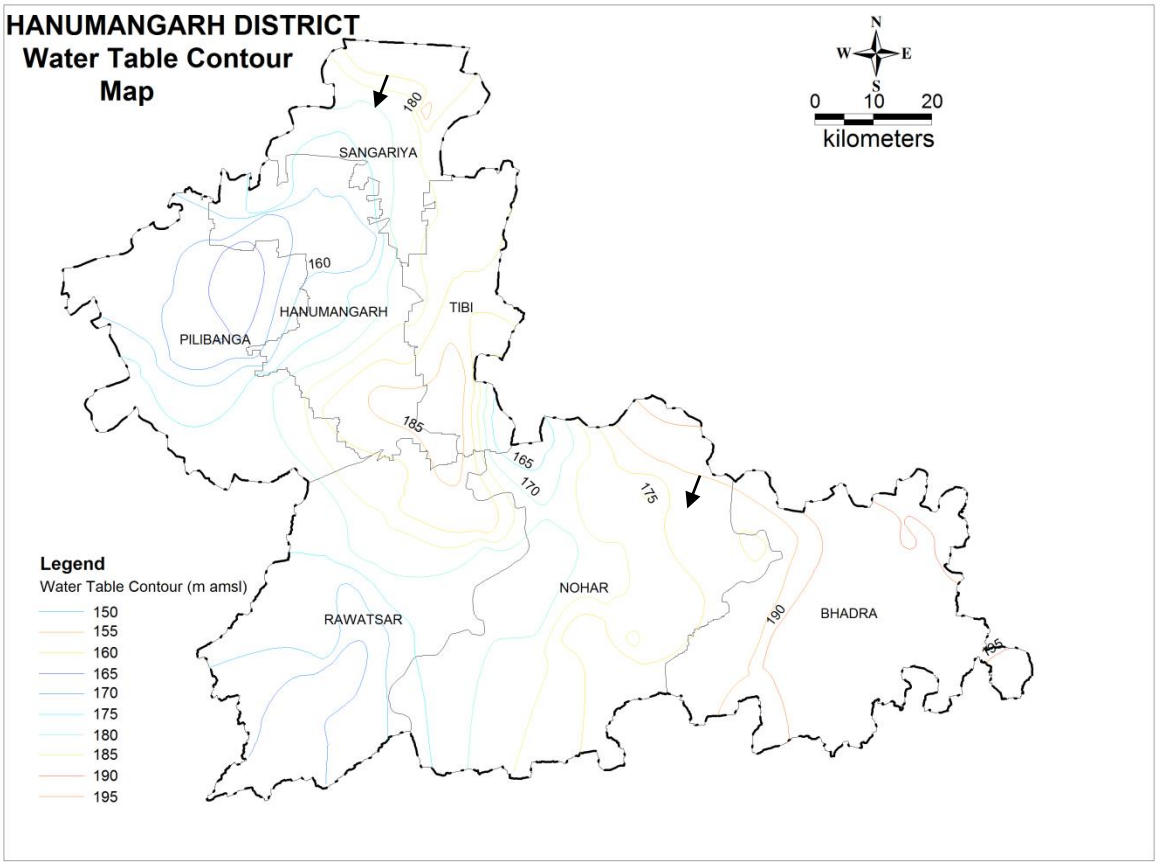


Figure 4.4.Water Table Elevation Contour Map-Pre Monsoon 2020.

4.3.3 Decadal Water Level Trend

Water level trend analysis for pre and post monsoon seasons during the past decade (2010 – 2019) was done to know the long-term scenario of ground water regime in the district. Long term data of about 105wells was available for trend analysis out of which 86 are used for analysis. The average groundwater trend of the district is declining at an average rate of 1.44 m/year in the pre-monsoon season, but in post-monsoon season rate of decline is 1.45 m/year .However rise of average waterlevel ranges from -2.25 m/y to -2.74 m/year of pre monsoon and post monsoon respectively.

Table 4.9: Block-wise Water level trend Ranges from (2010 to 2019) of Hanumangarh

Block	Fall(Pre 2010 - 2019) m/ year			Rise(Pre 2010 - 2019) m/ year			Fall(Post2010 - 2019)m/ year			Rise(Post 2010 - 2019)m/ year		
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max
Bhadra	2.801193	0.186975	8.333333	-2.98999	-14.4547	-0.5343	1.11172	0.195866	2.103105	-3.16104	-9.89591	-0.68999
Hanumangarh	1.204591	0.007471	4.007529	-1.92684	-5.70775	-0.04847	1.212356	0.072485	5.296267	-3.07379	-7.81825	-0.07598
Sangaria	1.015345	0.38581	1.644881	-3.76881	-8.014	-0.37039	0.99498	0.289133	1.700828	-2.87923	-4.57915	-0.3507
Nohar	1.699646	0.557994	4.457539	-1.71875	-4.18933	-0.11332	3.49383	0.038812	11.75772	-2.55893	-7.09831	-0.06118
Rawatsar	0.846309	0.097966	2.420706	-1.86206	-5.54839	-0.05179	0.671226	0.009621	2.274453	-3.51257	-9.07014	-0.26181
Pilibanga	1.454122	0.177561	3.613257	-0.30153	-0.40581	-0.14187	1.111703	0.234855	2.01209	-1.22994	-2.27703	-0.23038
District	1.441257	0.002874	8.333333	-2.25759	-14.4547	-0.04847	1.452095	0.009621	11.75772	-2.74857	-9.89591	-0.06118

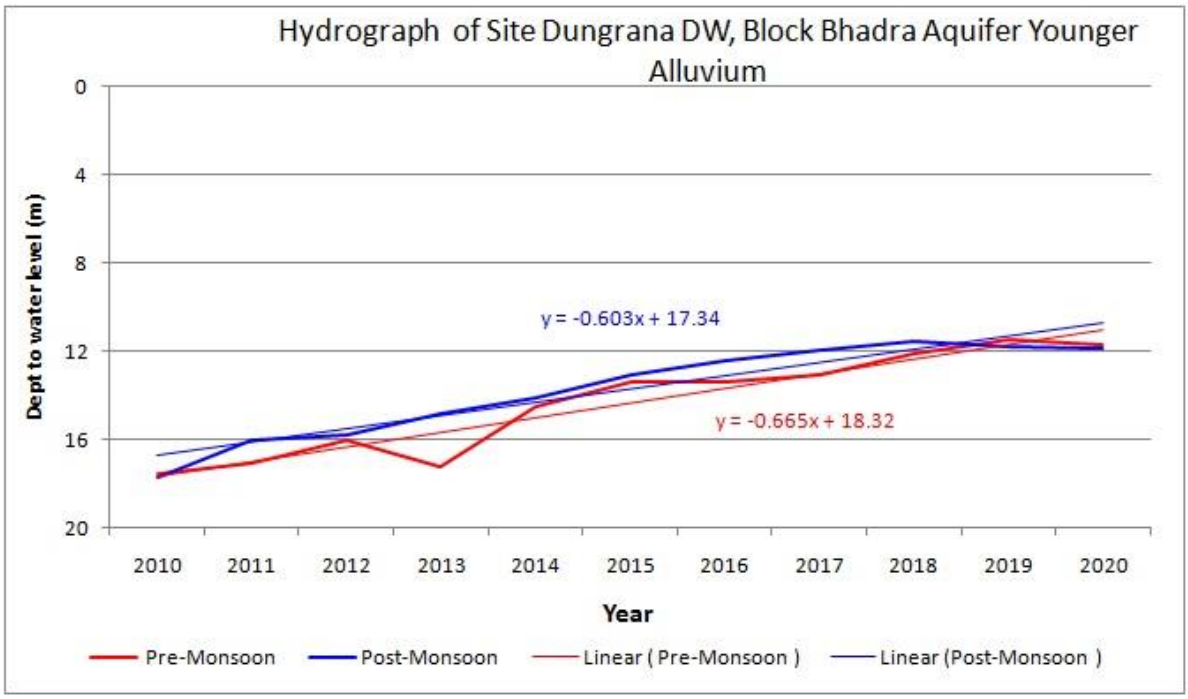


Figure 4.5: Hydrographs showing rising trends

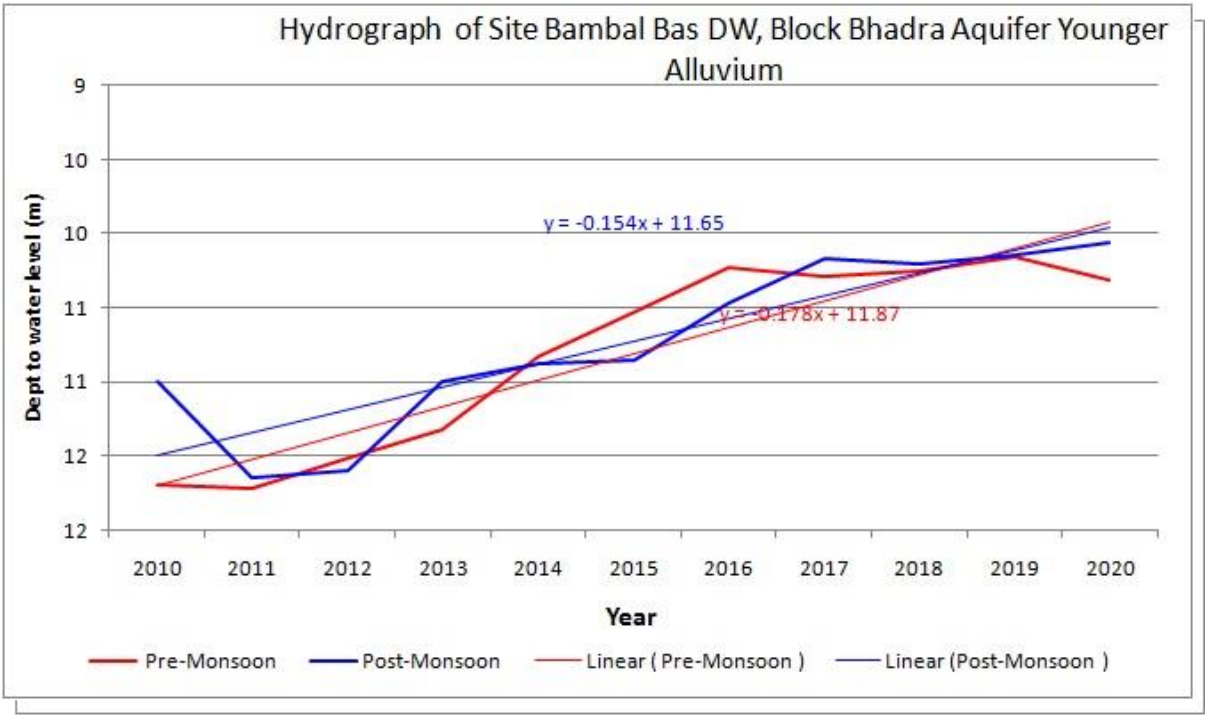


Figure 4.6: Hydrographs showing rising trends

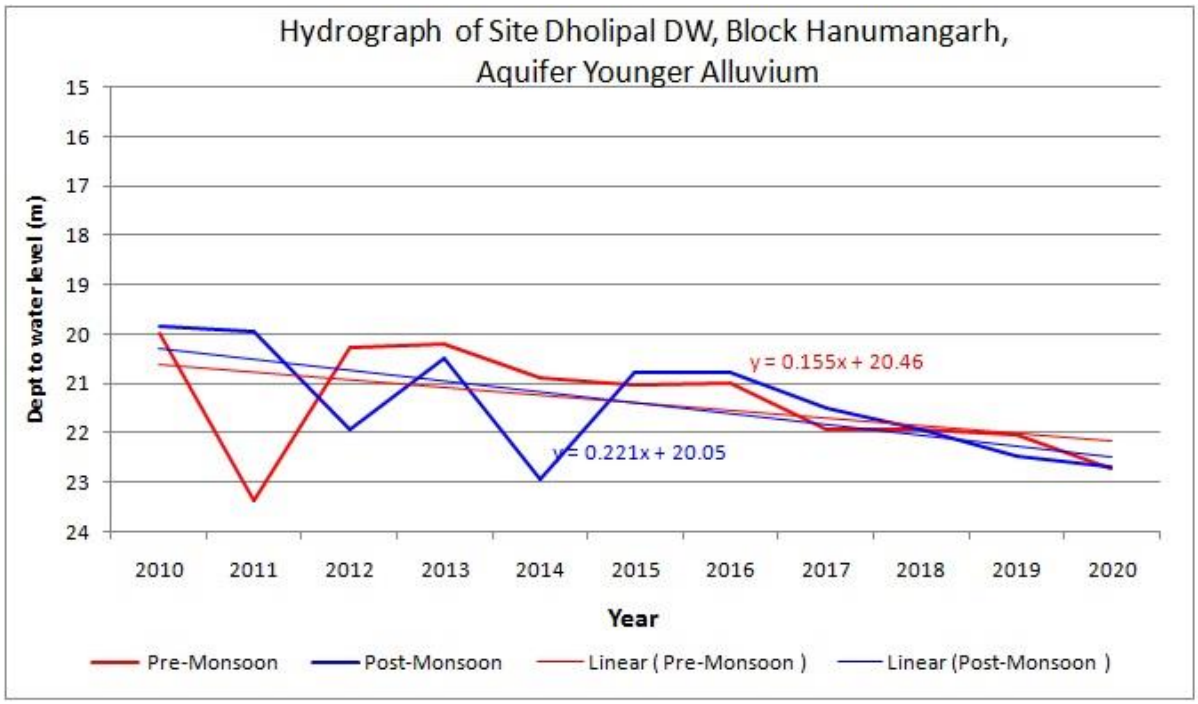


Figure 4.7: Hydrographs showing falling trends

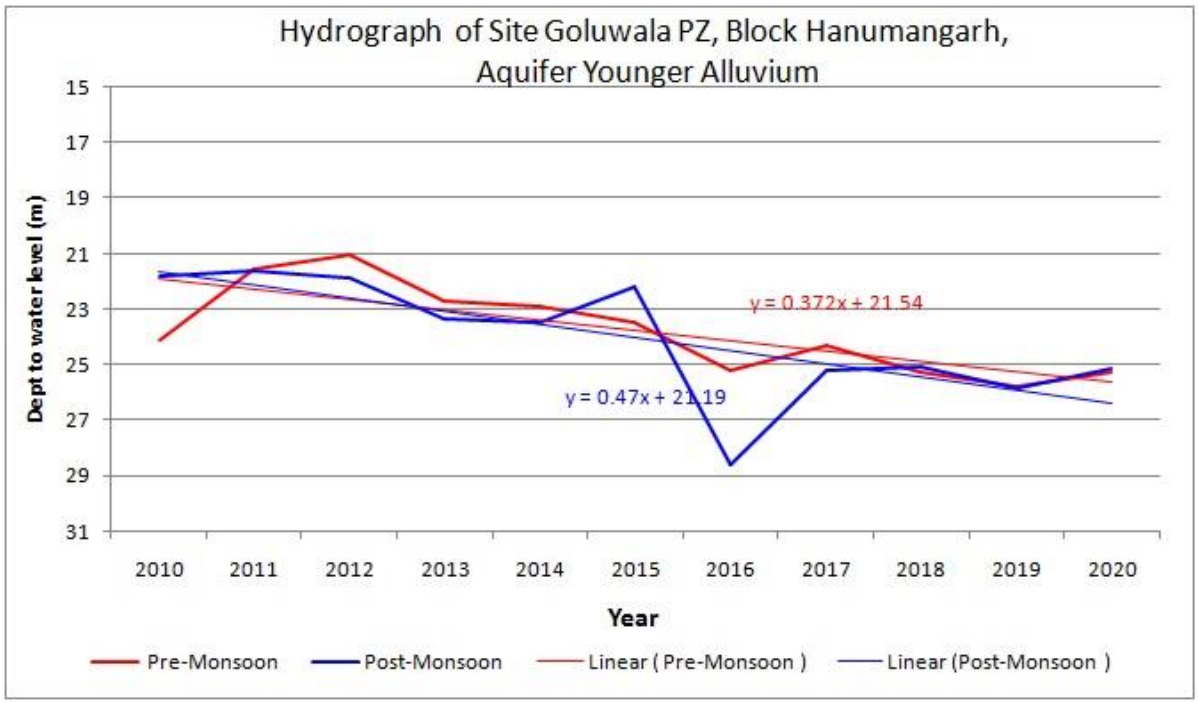


Figure 4.8: Hydrographs showing falling trends

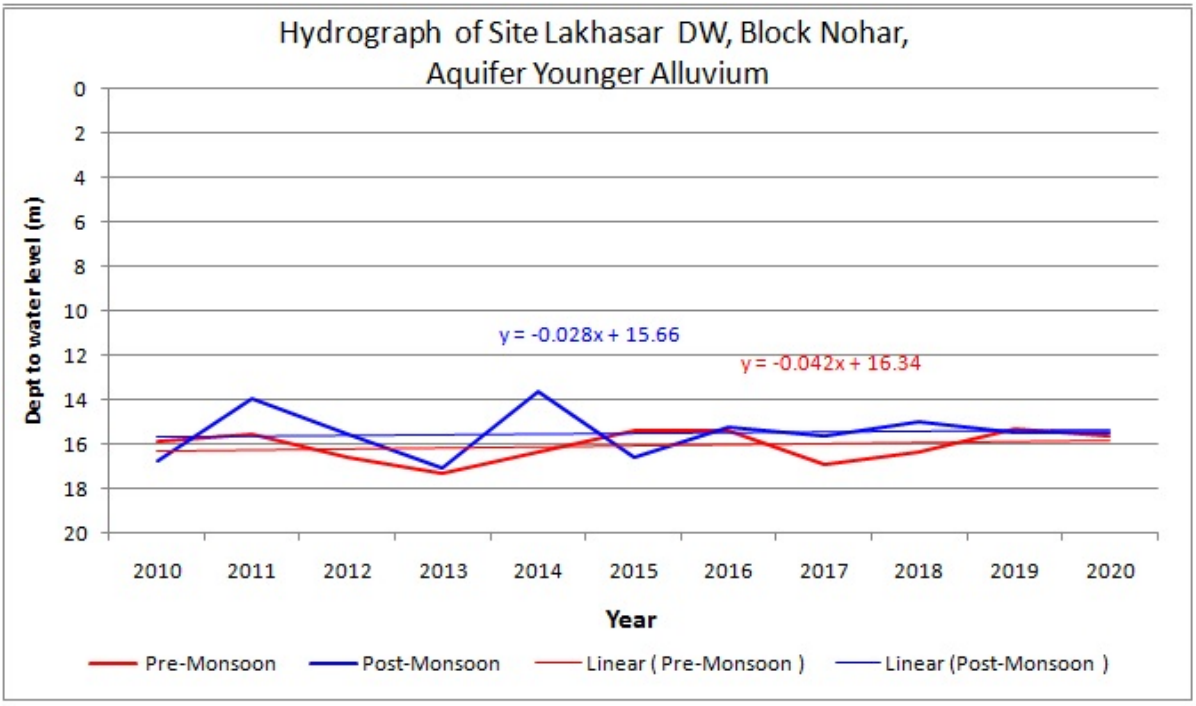


Figure 4.9: Hydrographs showing rising trends

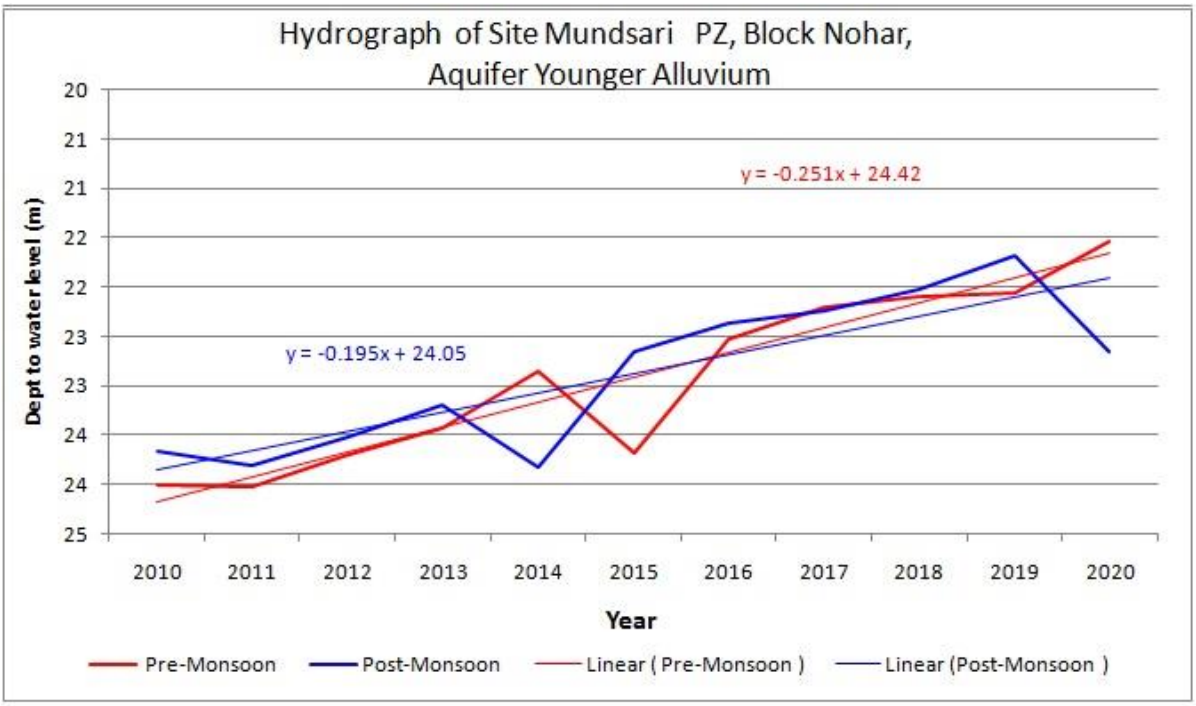


Figure 4.10: Hydrographs showing rising trends

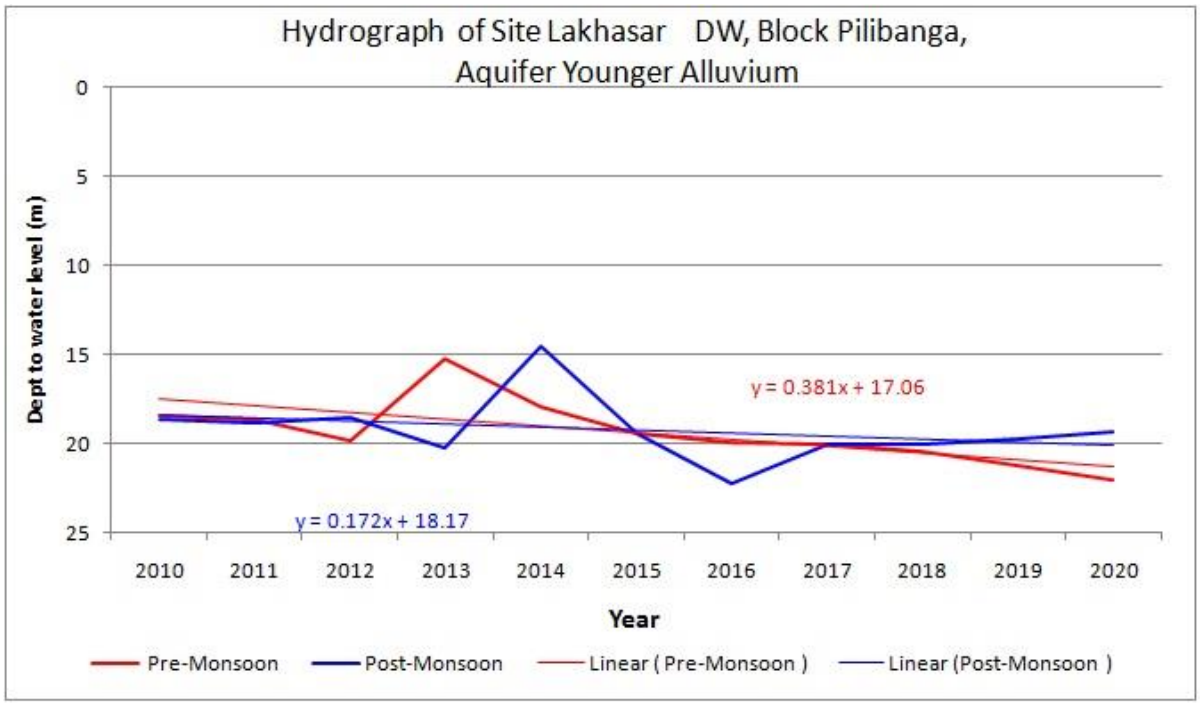


Figure 4.11: Hydrographs showing falling trends

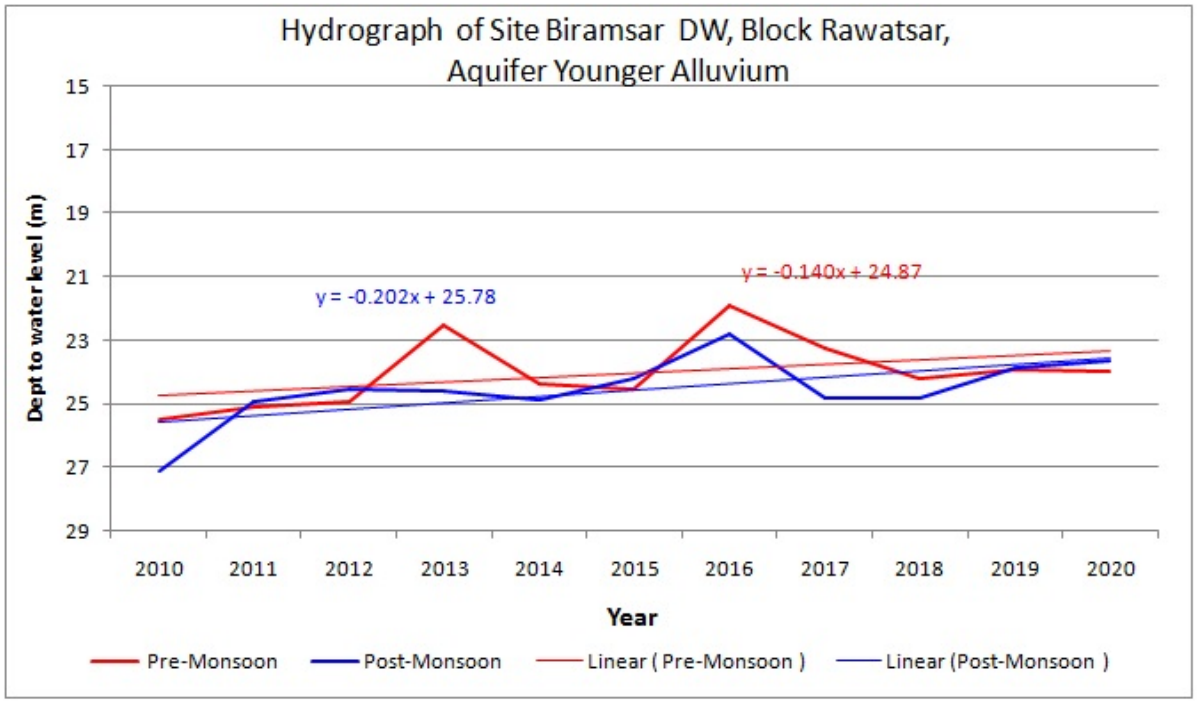


Figure 4.12: Hydrographs showing rising trends

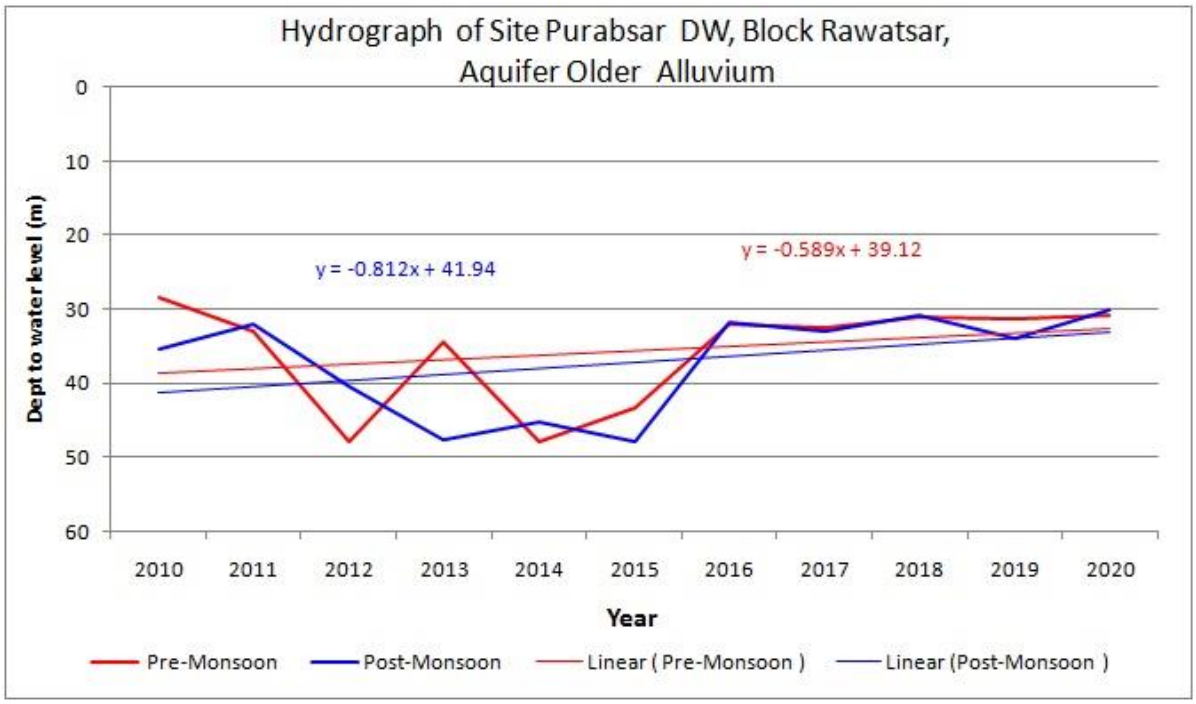


Figure 4.13: Hydrographs showing rising trends

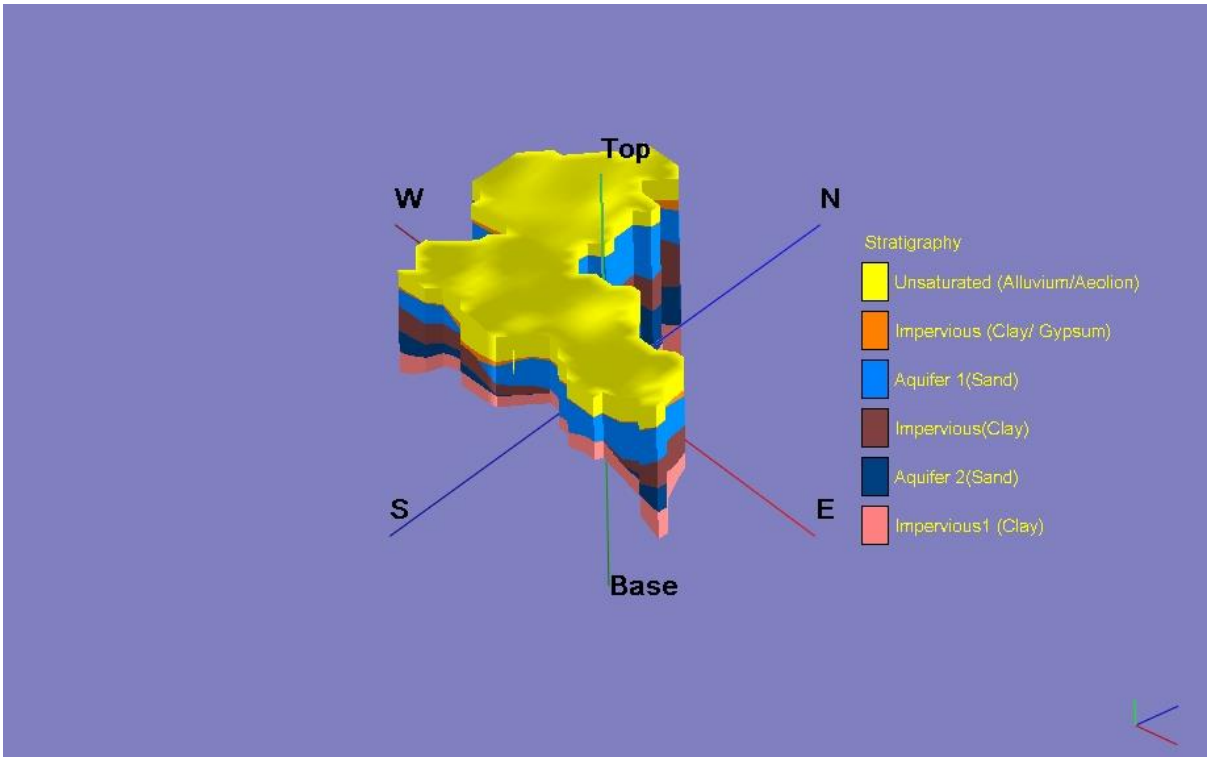
5.0 Aquifer Maps and Aquifer Characteristics

5.1 Aquifer Disposition

The data generated during ground water exploration by constructing exploratory wells, observation wells, slim holes and piezometers (Annexure-IV), was utilized to decipher the aquifer disposition in the area. This particularly includes the information on geometry of aquifers and hydrogeological information of these aquifer zones (figure 5.1). Three main types of formations are observed in the area i.e. Alluvium, Tertiary sand stone and Nagaur Jodhpur sand stone.

Aquifer System: Two

Zone 1 : Alluvium
Zone 2 :Alluvium & Tertiary Sand stone



5.2 AQUIFER CHARACTERSTICS

Table 5.1: Aquifer Characteristics Derived from Exploration in HAnumangarh District

Block	Aquifer		Depth Drilled (m)	SWL(mbmp)	Discharge (lpm)	Draw down (m)	Transmisivity (m2/day)	Storage cofficient
Tibbi	Younger alluvium	Average	193.3107	12.40286	912.5	8.083333	1116	
		Min	141.2	3.33	400	4.08	1116	
		Max	256.4	21.85	1800	14.6	1116	
Sangariya	Younger alluvium	Average	150.3333	19.68667	375			
		Min	62	16.3	200			
		Max	200	24.46	550			
Rawatsar	Younger alluvium	Average	182	26	250			
		Min	182	26	250			
		Max	182	26	250			
Pilibanga	Younger alluvium	Average	180.0208	18.3575	459.25	4.015714	1486	0.0089
		Min	130	6.13	100	1.98	1392	0.0028
		Max	200	25.43	1000	4.25	1486	0.0089
Nohar	Younger alluvium	Average	143.8867	22.234	332.5			
		Min	97.3	16.16	100			
		Max	188.92	30.98	480			
Hanumangarh	Younger alluvium	Average	164.7163	17.79583	624.6957	5.92	747	0.007333
		Min	70.4	9.3	160	1.6	80	0.0025
		Max	201	31.93	1200	13.54	747	0.013
Bhadra	Younger alluvium	Average	131.16	14.332	480			
		Min	93.8	7.5	300			
		Max	150	19.6	700			
District	Younger alluvium	Average	171.7115	17.25172	614.8226	5.352273	1054.833	0.00796
		Min	0	3.33	30	1.6	80	0.0025
		Max	256.4	32	2000	14.6	1580	0.015

6.0 GROUND WATER QUALITY

The concentrations of various gases and ions dissolved in water from the atmosphere, soil strata and minerals and rocks with which it comes are the characteristics of water. This ultimately decides the quality of ground water. The concentration of CO_3^{2-}, HCO_3^-, OH^- and H^+ ions and dissolved CO_2 gases in water decide the acidic or basic nature of water while the salts of ions like Ca^{2+} and Mg^{2+} in water makes it soft or hard. Water with high Na^+ and Cl^- concentration can make the water saline. Nitrate ions percolated from anthropogenic sources can become predominant major anion in ground water. The excess fluoride concentration in ground water from fluoride bearing minerals may be related to the concentration of Ca^{2+}, Na^{2+} and HCO_3^- ions present in ground water.

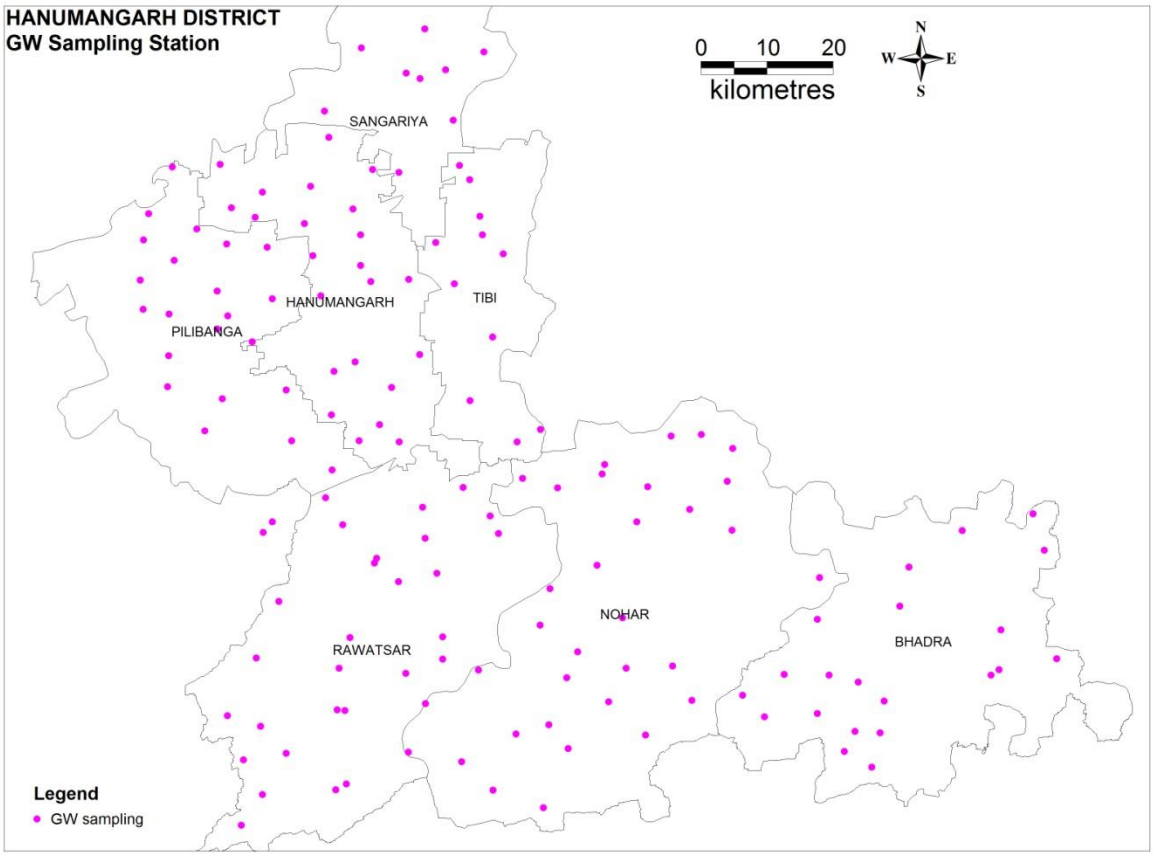


Figure 6.1: Map showing Water Quality Sampling Locations

A total of 156 samples (CGWB– 46, NAQUIM-110) collected during pre-monsoon 2019 were analyzed for generating the map to study ground water quality (figure 6.1). The well-wise quality details are presented in Annexure VI.

Table 6.1: Stasticical analysis of chemical quality of Hanumangarh District

Sr. No			PH	EC *in µS/cm at 25° C	CO_3	HCO_3	Cl*	SO_4	NO_3*	F*	PO_4	TH*	Ca*	Mg	Na*	K*	TDS
1	Bhadra	Average	7.963	3038.6	7.2	267.52	635.68	386.2	22.3468	0.1432	1.000004	576.8	91.76	84.338	443.9168	8.981616	1944.704
		Min	7.2	350	0	49	7	32	0	0.001	0.05	150	20	7.96	7.82	0.509	224
		Max	8.42	30000	72	1220	8827	2336	208	1.3	4.76	5300	820	789	4456	87	19200
		SD	0.285437	6140.82	20.191901	265.3617	1771.28	629.8655	43.55487	0.299099	1.019732	1021.762	159.3195	152.7042	952.5285	17.145188	3930.125
2	HANUMANGARH	Average	8.048205	2841.154	6	369.1282	440.6923	481.6154	46.32252	1.410585	0.045	685.7692	115.4359	96.55923	354.0769	18.21538	1818.338
		Min	7.34	260	0	49	14.2	12	0.8	0.1	0	80	8	1.88	15	3	166.4
		Max	8.93	8190	48	1305	1787	2427	384	7	0.2	2440	416	388	1143	210	5241.6
		SD	0.340679	2242.185	12.76508	217.5699	453.6934	555.9534	73.33543	1.538443	0.050512	599.1151	112.0784	89.83443	319.9584	32.64263	1434.998
3	Pillbanga	Average	7.9235	5930	4.5	407.75	1264.625	877.375	22.93274	1.999088	0.30525	1111.25	212.75	140.9075	887.8775	19.4775	3795.2
		Min	7.56	960	0	268	43	98	5.137879	0.78533	0.12	170	39	15.25	67	6.32	614.4
		Max	8.4	15600	36	498	4183	2672	67	5.4	0.57	3500	600	486	1976	39	9984
		SD	0.293558	5681.758	12.72792	74.42119	1493.369	899.3976	19.32579	1.526718	0.251446	1240.094	214.8985	174.0643	807.8077	10.801911	3636.325
4	Nohar	Aver	7.907	4197.	4.258	323.7	876.4	529.6	95.89	0.183	1.965	766.0	139.8	101.0	612.3	33.72	2686.

		age	419	871	065	419	194	742	903		548	323	065	548	548	581	637
		Min	7.47	240	0	73	14	0.4	2	0.004	0.05	40	8	5	5	0.55	153.6
		Max	8.48	41830	96	952	8862	7608	775	1.55	10	7600	1200	1117	6138	233	2677 1.2
		SD	0.283819	7868.871	18.21166	243.308	1804.2566	1375.691	186.8419	0.375115	2.274927	1408.444	241.2888	202.7424	1242.626	62.585543	5036.0078
5	Rawtsar	Average	7.743529	2504.471	3.882353	308.4848	44.4848	235.1152	84.24597	0.338404	1.384688	472.5758	94.272733	57.489099	330.0606	12.437888	1602.861
		Min	1.54	260	0	98	21	2	3	0.01	0.05	40	12	1.87	7	1.1	166.4
		Max	8.42	14420	72	744	3732	1208	700	2.3	5	1825	524	175	2290	48	9228.8
		SD	1.124237	3001.236	14.08015	196.728686	768.361	372.105	156.8076	0.503484	1.376691	443.313	107.166	55.046889	485.826	11.625611	1920.791
6	SANGARIYA	Average	8.057273	4488.182	13.09091	352.2727	710.8182	895.2727	42.82527	0.897364	0.111	1271.818	171.0909	204.9791	452.6364	23.014555	2872.436
		Min	7.34	310	0	108	31	63	7	0.2156	0.06	145	20	6.74	26	6.3	198.4
		Max	8.47	13500	72	536	2588	2744	117	1.2974	0.16	5100	580	886	1081	93	8640
		SD	0.335264	3981.426	26.53848	121.776055	784.1914	885.4515	34.50513	0.308153	0.070711	1434.884	169.729	249.0212	335.1988	24.298	2548.113
7	Tibbi	Average	6.107678	4476.618	22.29931	382.3373	851.1887	1008.042	88.22355	1.595941	0.087028	1469.573	199.0348	240.3767	465.8588	51.308894	2865.036
		Min	0.335264	260	0	49	14.2	12	0.8	0.1	0	80	8	1.88	15	3	166.4
		Max	8.93	1350	72	1305	2588	2744	384	7	0.2	5100	580	886	1143	210	8640

				0													
		SD	3.600177	4444.32	25.5916	406.630	895.722	1029.663	125.057	2.255794	0.065776	16	19	29	42	69.95	28
												56.998	8.9075	1.4895	8.4019	33.33	44.366
8	District	Average	7.931987	3289.333	5.807692	329.742	607.548	467.529	57.3666	0.730309	1.014379	690.8194	118.7806	95.66432	442.834	18.52715	2105.173
		Min	1.54	240	0	49	7	0.4	0	0.001	0	40	8	1.87	5	0.509	153.6
		Max	8.93	41830	96	1305	8862	7608	775	7	10	7600	1200	1117	6138	233	26771.2
		SD	0.597988	4967.756	16.90046	214.719	1232.695	813.2067	121.4024	1.107221	1.542744	957.7778	160.5906	143.4687	766.955	35.26835	3179.364

6.1 Major Quality Parameters

Electrical Conductivity (EC)

Electrical conductivity is a measure of total mineral contents of dissolved solids in water. It depends upon the ionic strength of the solution. An increase in dissolved solids causes a proportional increase in electrical conductivity. The electrical conductivity value of ground water in Hanumangarh district found to vary from 240 to 41830 µS/cm at 25°C.. The spatial variation of EC shows that in maximum area the groundwater has EC values between < 2000 µS/cm at 25°C has been observed in 55% of ground water samples As the sediments are finer, flushing of ground water is not proper and longer residence time of water in the aquifer results in dissolution of salts from the aquifer material, which leads to higher TDS content and in turn higher EC.

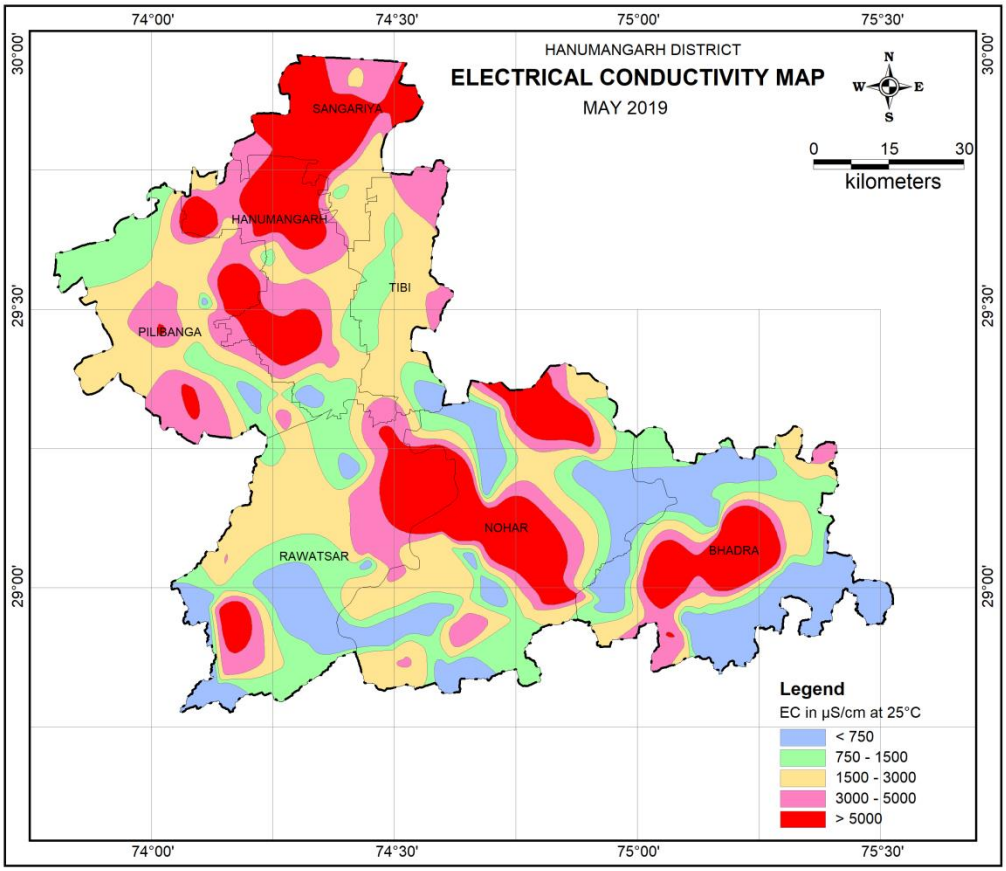


Figure 6.2: Map showing EC variation in Hanumangarh district

Nitrate

Concentration of nitrate (NO_3^-) has been found to vary from < 1 mg/l to 7 mg/l. to 775 Nitrate concentration marginally exceeds the maximum permissible limit of 45 mg/l in drinking water prescribed by BIS (IS-10500:2012) in around 28 % of the total ground water samples. Nitrate in excess of maximum permissible limit has been reported in all blocks of the hanumangarh district. Higher concentrations of NO_3^- can be attributed to the sampling from application of more fertilizers and sewage carrying drains. Excess nitratein drinking water can cause methaemoglobinaemia in infants, gastric cancer, goiter, birth malformations and hypertensions

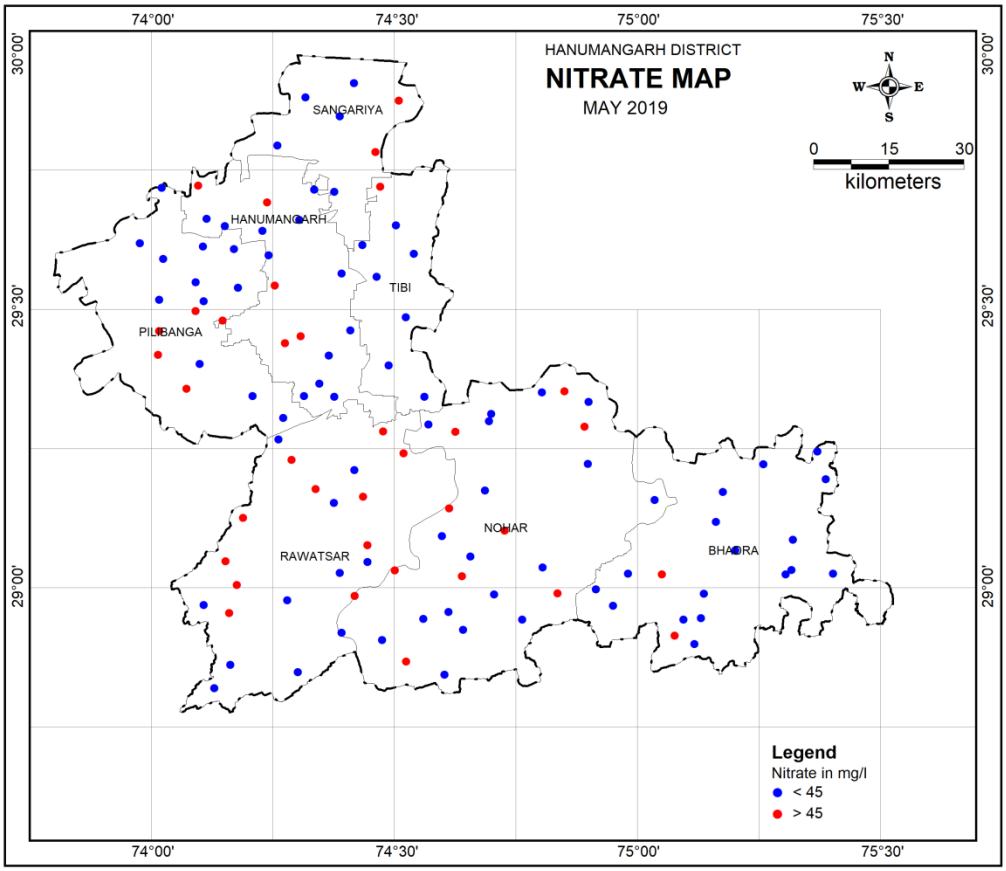


Figure 6.3: Map showing EC variation in Hanumangarh district

Fluoride

Fluoride (F^-) is an essential element for maintaining normal development of healthy teeth and bones. However, higher Fconcentration 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 0.01 and 7.6 mg/l. Concentration of F is within desirable limit of 1 mg/l BIS (IS-10500:2012) in 44% of samples whereas it is between desirable and permissible limits in 18% samples and exceeds the maximum permissible limit of 1.5 mg/l (IS-10500: 2012) in 36% of the total analysed samples

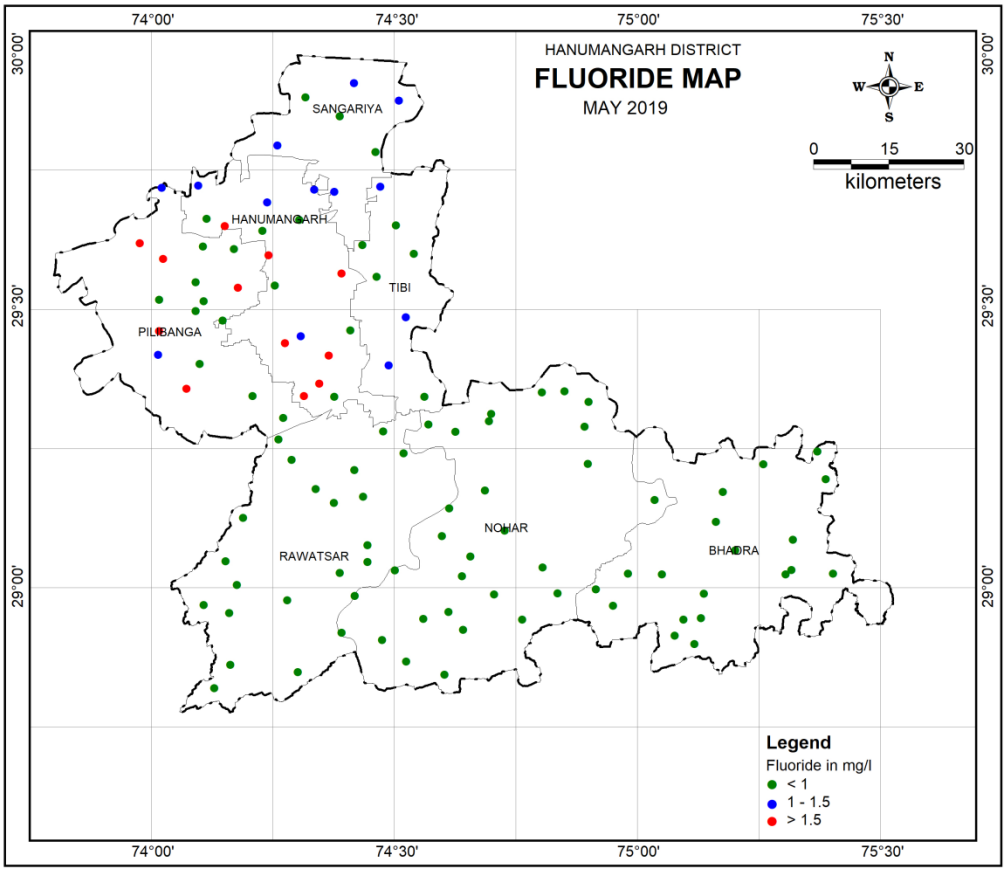


Figure 6.3: Distribution of Fluoride in Hanumangarh District

6.2 Suitability of Ground Water for Drinking Purposes

Total Hardness (TH)

Classification of ground water samples based on Total Hardness (TH) is given in Table 6.2. TH has been found to vary between 50 mg/l and 1650 mg/l, indicating soft 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.

Table 6.2: Hardness Classification of water

Hardness (mg/l)	Water Class	No. of Samples	% Sample
0 – 75	Soft	2	1.282051
75 – 150	Moderately Hard	24	15.38462

150 – 300	Hard	43	27.5641
>300	Very Hard	88	56.41026

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 153 mg/l to 267 71.2 mg/l. TDS of 77% of analyzed water samples falls in the category of fresh water, while 21% samples have TDS in the range of 3000 - 10,000 mg/l and fall in brackish water category (table 6.3).

Table 6.3: Classification of water based on Total Dissolved Solids

Parameter	**Water class**	**Hanumangarh**	**Sangariya**	**Tibbi**	**Pilibanga**	**Rawatsar**	**Bhadra**	**Nohar**	**District**
TDS (mg/L)	Ranges	% of Sample	% of Sample	% of Sample	% of Sample	% of Sample	% of Sample	% of Sample	% of Sample
Fresh	0-3000	76.92308	54.54545	100	50	85.29412	80	77.41935	77.5641
Brackish	3000-10000	23.07692	45.45455	0	50	14.70588	16	19.35484	21.15385
Saline	>10000	0	0	0	0	0	4	3.225806	1.282051
Brine	>35000	0	0	0	0	0	0	0	0

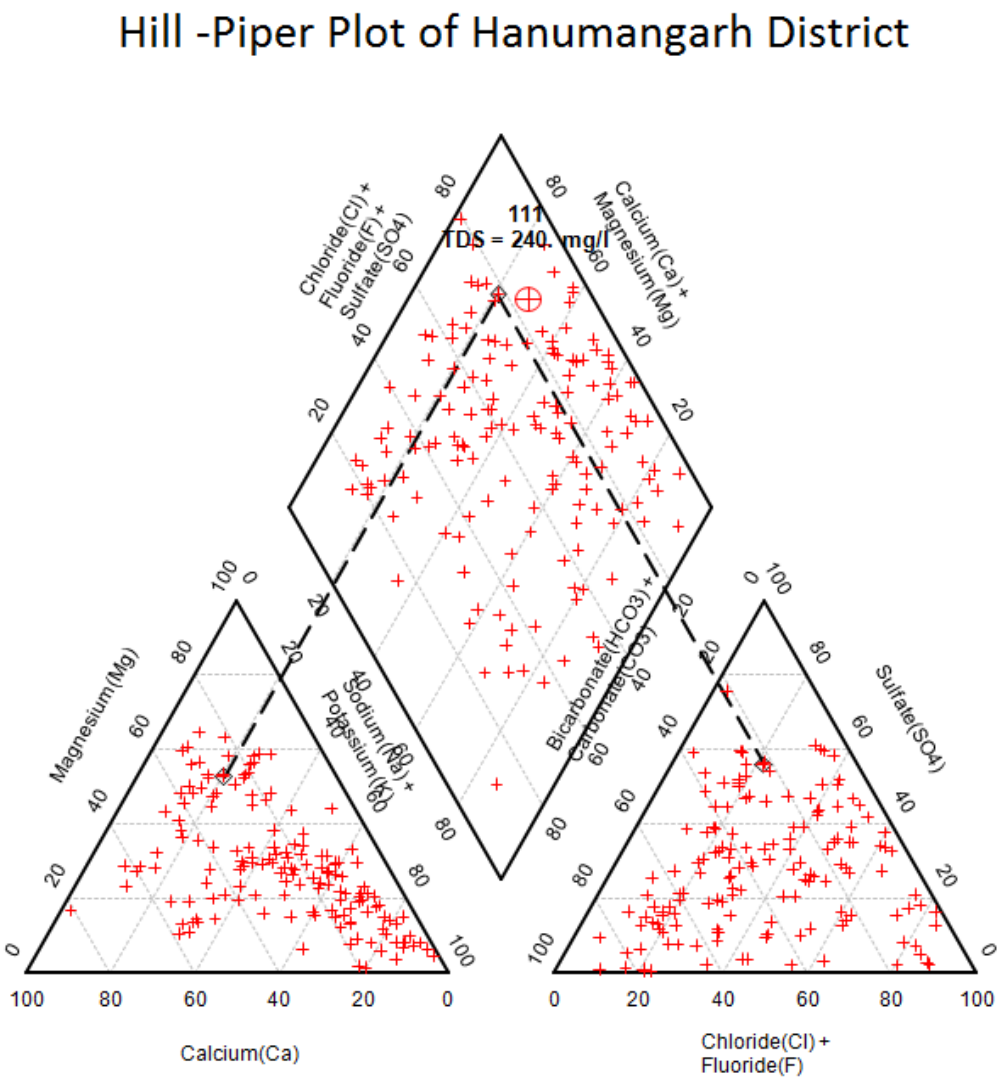


Figure 6.4: Hill Piper Diagram Hanumangarh District

6.3 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 tables 6.4, 6.5 and 6.6.

Table 6.4: Classification of Ground Water Samples based on EC

	Electrical Conductivity µS/cm at 25° C			Classification of water	Activity required
Type of Water	**Range**	**No. of Samples**	**% of Samples**		
Low Saline	>250	1	0.645161	Excellent	• Good for all crops • little likelihood of development of salinity
Medium Saline	250-750	45	29.03226	Good	• Plants with moderate salt tolerance • No special practices for salinity control required. • Moderate amount of leaching occurs.
Highly Saline	750-2250	45	29.03226	Doubtful	• Cannot be used on soils with restricted drainage. • Even with adequate drainage, special management for salinity control may be required • Plants with good salt tolerance should be selected.
Very Highly saline	> 2250	64	41.29032	Unsuitable	• Not suitable for irrigation under ordinary condition. • soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching • very salt tolerant crops should be selected
		155	100		

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.

Table6.5: Classification of Ground Water Samples based on SAR

Type of Water	Sodium Adsorption Ratio			Classification of water
	Range	No. of samples	% of Samples	
Low Sodium Water	< 10	125	80.64516	Excellent
Medium Sodium Water	10 to 18	16	10.32258	Good
High Sodium Water	18 to 26	10	6.451613	Doubtful
Very High Sodium Water	>26	4	2.580645	Unsuitable
Total		155	100	

Table 6.6 :Classification of Ground Water Samples based on Na%

Water Class	Na%		
	Range	No. of samples	% of Sample
Excellent	< 20	25	16.12903
Good	20 - 40	41	26.45161
Medium	40 - 60	39	25.16129
Bad	60 - 80	34	21.93548
Very Bad	> 80	16	10.32258
Total		155	100

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.

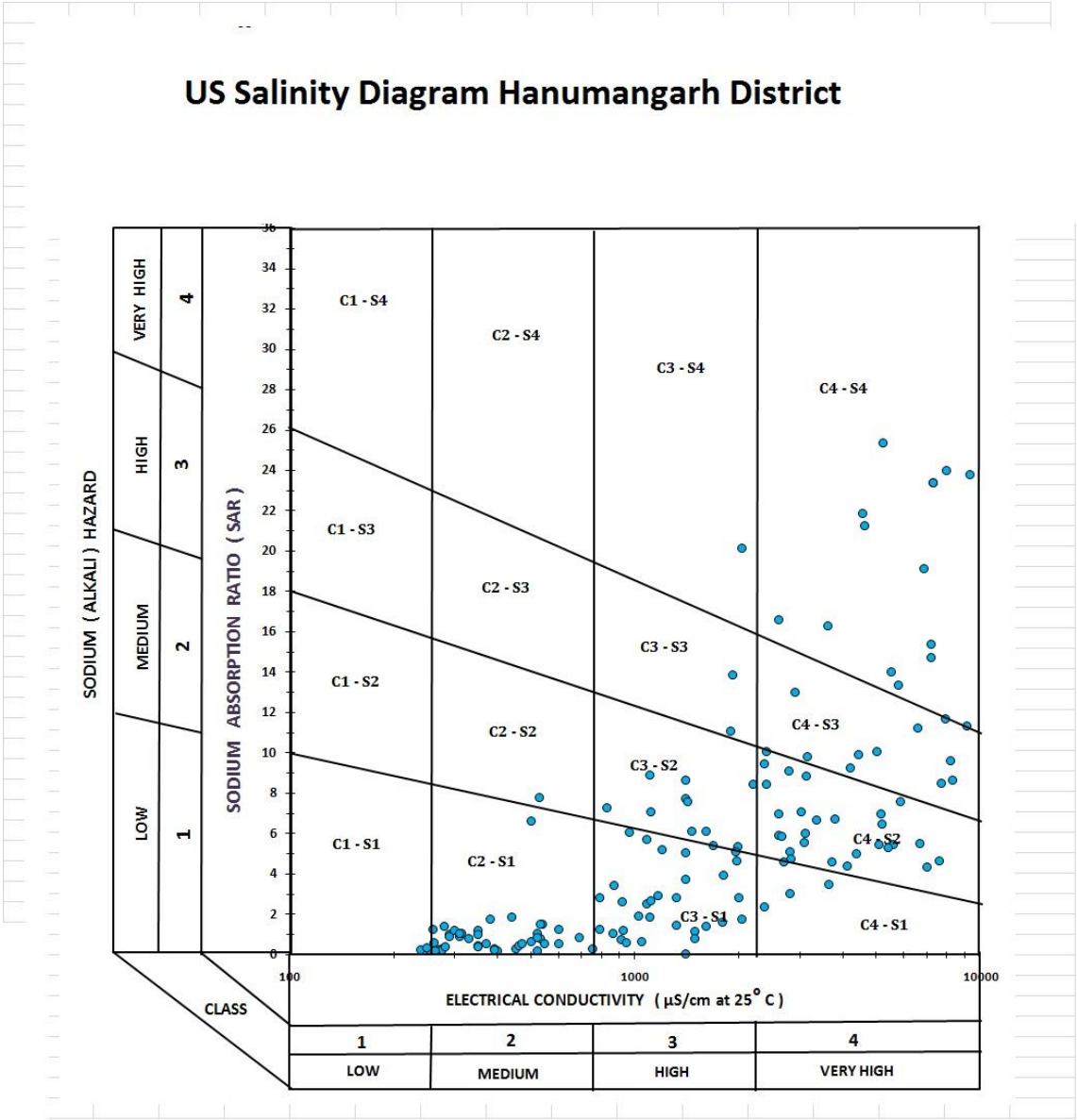


Figure 6.5: US Salinity Diagram

The calculated value of SAR in the study area ranged from 0.076 – 66.06 The plot of data on the US salinity diagram, in which the EC is taken as salinity hazard and SAR as alkalinity hazard, shows that most of the water samples fall in the category C2S1, C3S1, C3S2, C3S3, C3S4, C4S2, C4S3 and C4S4, indicating medium to very high salinity and low and very high alkali water. This water can be used only for plants with good salt tolerance (figure. 6.4).

RSC values in 59.6% analysed samples of Hanumangarh District were found to be <1.25 and 10.8% varied between1.25 to 2.5 meq/l. It indicates safe to marginal quality of ground water for irrigation uses. In only 3.36% samples, RSC value varied between 2.0 and 3.0 meq/l and 26% samples exceeded 3.0 meq/l limits. The high RSC value makes the groundwater unsuitable for irrigation uses.

The block-wise analysis for RSC values for assessing suitability of groundwater for irrigation is presented in table 6.7. The analysis of table indicates that groundwater in the southern blocks of the district is more suitable for irrigation as compared to the northern blocks viz. Bamanwas, Gangapur City and Bonli.

Table 6.7: Classification of Ground Water Samples based on RSC

RSC (meq/l)	Bhadra	Hanumangarh	Nohar	Pilibanga	Sangariya	Tibbi	Rawatsar	District
Range	% samples	% samples	% samples	% samples	% samples	% samples	% samples	% samples
< 1.25	92	84.61538462	87.09677419	75	81.81818182	87.5	78.78787879	84.51612903
1.25 - 2.0	4	0	0	0	0	0	6.060606061	1.935483871
2.0 - 2.5	0	0	6.451612903	0	0	0	3.03030303	1.935483871
2.5 - 3.0	0	0	0	0	0	12.5	0	0.64516129
> 3.0	4	15.38461538	6.451612903	25	18.18181818	0	12.12121212	10.96774194

From the above analysis it can be inferred that most parts of the district has medium to high salinity and excellent to good Sodium Adsorption ratio making the water suitable for irrigation with the promotion of salt tolerant crops in areas having high salinity.

7.0 Ground Water Resources

The ground water resource assessment as on March 2017 has been carried out and the salient features of the resources are given in Table

As per table-7.1, out of the total 9579.6 sq km area, of which recharge worthy areas are 1278.5 sq km and 5613.9 sq km is canal command areas and 3965.7 sq km in non-command areas.

Table 7.1: Area for Resource assessment (as on March 2017) in Hanumangarh District

Sr.No	Block	Geographical Area of Block (sq km)	Hilly Area (sq km)	Potential Area (sq km)	Command area (sq km)	Non-command area (sq km)
1	Bhadra	1776.8	0	158.10	804.7	972.1
2	Hanumangarh	1112.38	0	245.21	1112.38	0
3	Nohar	2439.45	0	57.10	498.54	1940.91
4	Pilibanga	1128.02	0	392.24	1128.02	0
5	Rawatsar	1672.25	0	0.00	619.56	1052.69
6	Sangaria	693.19	0	180.76	693.19	0
7	Tibbi	757.51	0	245.09	757.51	0
8	District	9579.6	0	1278.5	5613.9	3965.7

Table 7.2: GW availability Verses Draft (as on March 2017) in Hanumangarh District

Block	**Area of Block**	**Type of area**	**Water Bearing Formation**	**Potential Zone Area**	**Total Annual Ground Water Recharge**	**Annual Extractable Ground Water Resource [(7) - (8)]**	**Current annual gross ground water extraction for 'Irrigation'**	**Current annual Gross Ground Water extraction for Dom.& Industrial Use**	**Current annual gross ground water extraction for 'All Uses'**	**Annual ground water allocation for domestic water supply as on 2025.**	**Net annual ground water availability for 'Future Use'**	**Stage of ground water Extraction as a percentage**	**Quantity Categorisation for future ground water development (Safe/ Semi-Critical/ Critical/ Over exploited)**
	(ha			**(ha)**	**(ha.**	**(ha.**	**(ha.**	**(ha.**	**(ha.**	**(ha.**	**(ha.**	**(%)**	

	.m)				m)	m)	m)	m)	m)	m)	m)		
1	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**17**
BHADRA	1776 80	C	"ALO1"	15810	2590.57	2461.04	1269.84	236.25	1506.09	318.94	872.26	61.20	
		C	"ALO1 (S)"	64660	0.00	5969.58	1526.47	192.50	1718.97	259.88	4183.24	28.80	
		NC	"ALO1(S)"	97210	3035.58	2883.80	0.00	0.00	0.00	0.00	2883.80	0.00	
Average of Block (Excl.Saline)				**15810**	**2590.57**	**2461.04**	**1269.84**	**236.25**	**1506.09**	**318.94**	**872.26**	**61.20**	**SAFE**
HANUMANGARH	111238	C	"ALO1a"	24521	3830.62	3447.55	2204.93	148.75	2353.68	200.81	1041.81	68.27	
		C	"ALO1 (S)"	86717	13915.12	12523.61	2984.23	6.30	2990.53	8.51	9530.87	23.88	
Average of Block (Excl.Saline)				**24521**	**3830.62**	**3447.55**	**2204.93**	**148.75**	**2353.68**	**200.81**	**1041.81**	**68.27**	**SAFE**
PILIBANGA	112802	C	"ALO1a"	39224	4651.91	4186.72	2719.59	192.50	2912.09	259.88	1207.26	69.56	
		C	"ALO1 (S)"	73578	8106.81	7296.13	2547.12	4.90	2552.02	6.62	4742.39	34.98	
Average of Block (Excl.Saline)				**39224**	**4651.91**	**4186.72**	**2719.59**	**192.50**	**2912.09**	**266.49**	**1207.26**	**69.56**	**SAFE**
SANGARIA	693319	C	"ALO1a"	9806	1771.90	1594.71	1046.95	52.50	1099.45	70.88	476.88	68.94	
		C	"ALO1b"	8270	2415.36	2173.83	1179.36	20.30	1199.66	27.41	967.06	55.19	
		C	"ALO1 (S)"	51243	8395.61	8143.48	3317.07	6.30	3323.37	8.51	4817.90	40.81	
Average of Block (Excl.Saline)				**18076**	**4187.26**	**3768.53**	**2226.31**	**72.80**	**2299.11**	**98.28**	**1443.94**	**61.01**	**SAFE**
TIBBI	757751	C	"ALO1a"	24509	4774.64	4297.18	2644.39	140.00	2784.39	189.00	1463.79	64.80	
		C	"ALO1 (S)"	51242	9904.35	8913.92	2253.53	7.00	2260.53	9.45	6650.93	25.36	
Average of Block (Excl.Saline)				**24509**	**4774.64**	**4297.18**	**2644.39**	**140.00**	**2784.39**	**189.00**	**1463.79**	**64.80**	**SAFE**
RAWATSAR	167225	C	"ALO1 (S)"	45946	8431.13	7588.02	2339.56	9.80	2349.36	13.23	5235.23	30.96	
		C	"ALO3 (S)"	16010	1553.00	1397.70	673.00	0.00	673.00	0.00	724.70	48.15	
		NC	"ALO3	105269	2111.15	1900.03	0.00	0.00	0.00	0.00	1900.03	0.00	

			(S)"										
Average of Block (Saline)				**16722 5**	**12095.28**	**10885.76**	**3012.56**	**9.80**	**3022.36**	**13.23**	**7859.96**	**27.76**	**Saline**
NOHAR	2439 45	C	"ALO1"	5710	984.93	886.44	531.67	14.00	545.67	18.90	335.87	61.56	
		NC	"ALO1 (S)"	10074 0	2982.19	2683.97	0.00	0.00	0.00	0.00	2683.97	0.00	
		NC	"ALO3 (S)"	9335 1	3209.52	2888.56	0.00	0.00	0.00	0.00	2888.56	0.00	
		C	"ALO1 (S)"	4414 4	4240.22	3816.20	1370.71	8.40	1379.11	12.60	2432.88	36.14	
Average of Block (Excl.Saline)				**5710**	**984.93**	**886.44**	**531.67**	**14.00**	**545.67**	**18.90**	**335.87**	**61.56**	**SAFE**
Average of District (Excl.Saline)				**12785 0**	**21019.92**	**19047.46**	**11596.72**	**804.30**	**12401.02**	**1092.42**	**6364.93**	**65.11**	
Average of District (Saline)				**83011 0**	**72234.28**	**65417.57**	**17011.70**	**235.20**	**17246.90**	**318.78**	**48674.52**	**26.36**	

As per resource estimation datareveals that the district hanumangarh falls under safe category with stage of development 65.1 %

In-storage Resources

Ground water resource assessment of the zone below water level fluctuation is carried out is presented in table 7.4.

Table 7.3: Block wise In-storage Resources of Hanumangarh

S. No.	Block	Area of Block (ham)	Potential zone	Potential zone area (ham)	Effective Area of Pot. Zone (ham.)	Average depth to W.L. (m. bgl) Pre-Mon. 2016	Average depth to Basement (m)	Saturated thickness (m)	Utilisable saturated thickness (m) (40% in Alluvium)	Specific Yield of aquifer	Static Resources in aquifer (hem)
1	2	3	4	5	6	7	8	9	10	11	12
1	Bhadra	177680	A	15810.00	15810.00	9.66	50.00	40.34	16.14	0.15	38266.52
	Total of Block			**15810.00**	**15810.00**						**38266.52**
2	Hanumangarh	111238	A	24521.00	24521.00	18.66	45.00	26.34	10.54	0.15	38752.99
	Total of Block			**24521.**	**24521.**						**38752.**

				00	**00**						**99**
3	Nohar	243945	A	5710.00	5710.00	16.88	55.00	38.12	15.25	0.15	13059.91
	Total of Block			**5710.00**	**5710.00**						**13059.91**
4	Pilibanga	12802.00	A	39224.00	39224.00	24.34	45.00	20.66	8.26	0.15	48622.07
	Total of Block			**39224.00**	**39224.00**						**48622.07**
5	Rawatsar	167225	A	Entire block has saline ground water							
	Total of Block			**0.00**	**0.00**						**0.00**
6	Sangaria	69319.00	A	18076.00	18076.00	7.31	45.00	37.69	15.08	0.15	40877.07
	Total of Block			**18076.00**	**18076.00**						**40877.07**
7	Tibbi	757551.00	A	24509.00	24509.00	7.31	45.00	37.69	15.08	0.15	55424.65
	Total of Block			**24509.00**	**24509.00**						**55424.65**
	Total of District			**127850.00**	**127850.00**						**235003.21**

The total in-storage resources of the district, comes to 2350.03 mcm. The block-wise sustainability period of aquifers, if the present ground water draft for all uses continues to be same, is calculated after considering both dynamic resources and in-storage resources and presented in table 7.5.

Table 7.5: Block wise Sustainability of Aquifer in Hanumangarh

Block	**Dynamic Resource**	**In-Storage Resources**	**Current annual gross ground water extraction for 'All Uses' (mcm)**	**Sustainability period of Aquifer**
	(mcm)	(mcm)	(mcm)	(years)
Bhadra	2461.04	38266.52	1506	Sustainble for long period of time
Hanumangarh	3447.55	38752.99	2353.68	Sustainble for long period of time
Nohar	886.44	13059.91	**545.67**	Sustainble for long period of time
Pilibanga	4186.72	48622.07	2912.09	Sustainble for long period of time
Rawatsar			**38752.99**	Sustainble for long period of time
Sangariya	3768.53	40877.07	2299.11	Sustainble for long period of time

Tibbi	4297.18	55424.65	**2784.39**	Sustainble for long period of time
District	65417.57	235003.2	17246.90	Sustainble for long period of time

8.0 Aquifer Management Plan

8.1 Ground Water Related Issues

1. Availability of fresh ground water in small area.

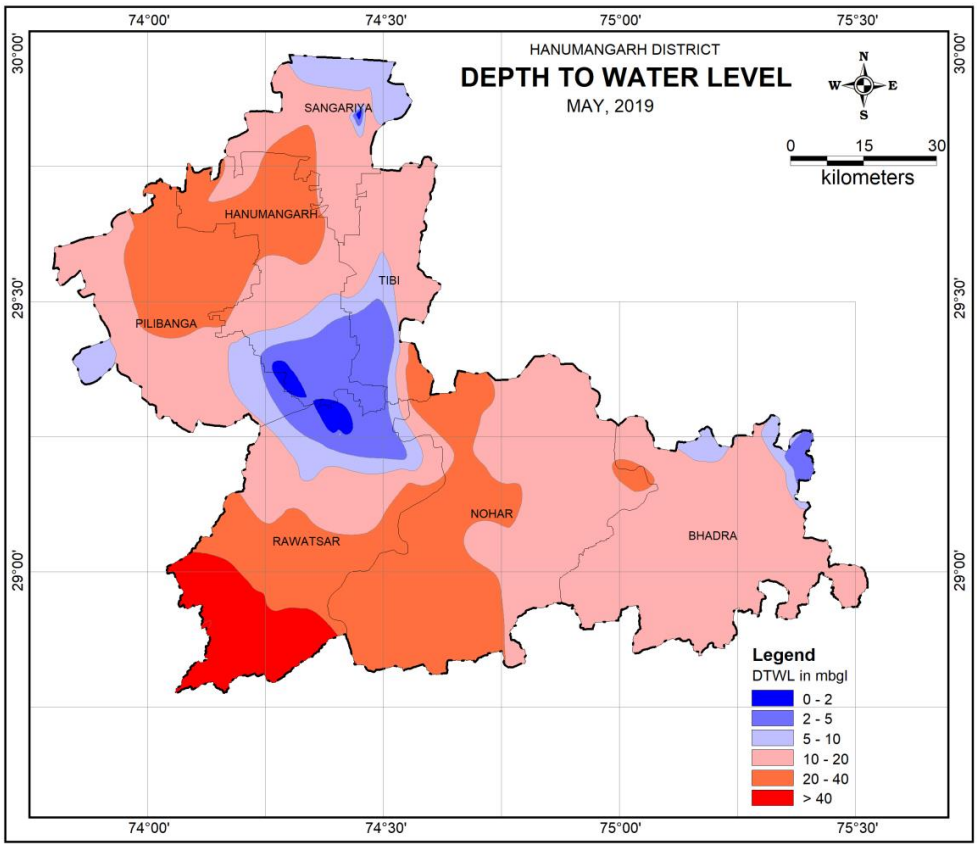
Table 8.0: Area wise distribution of saline and fresh ground water

Sr.No	Block	Geographical Area of Block (sq km)	Potential Area (sq km)	Saline area (sq km)	% Availability of of Fresh ground water area	%Availability of of Saline ground water area
1	Bhadra	1776.8	158.10	1618.70	8.898019	91.10198
2	Hanumangarh	1112.38	245.21	867.17	22.04373	77.95627
3	Nohar	2439.45	57.10	2382.35	2.340692	97.65931
4	Pilibanga	1128.02	392.24	735.78	34.77243	65.22757
5	Rawatsar	1672.25	0.00	1672.25	0	100
6	Sangaria	693.19	180.76	512.43	26.07654	73.92346
7	Tibbi	757.51	245.09	512.42	32.35469	67.64531
8	District	9579.6	1278.5	8301.10	13.34607	86.65393

As cited on the above table indicates that district has limitead fresh ground water potential area and nearly 87 % of the area of district is saline.

2. Water logging in canal command area.

Asshown in map that the area particularly Tibbi, Pilibanga and Rawtsar blocks of hanumangarh district have shallow ground water level and the area are higly pron to ground water logging.



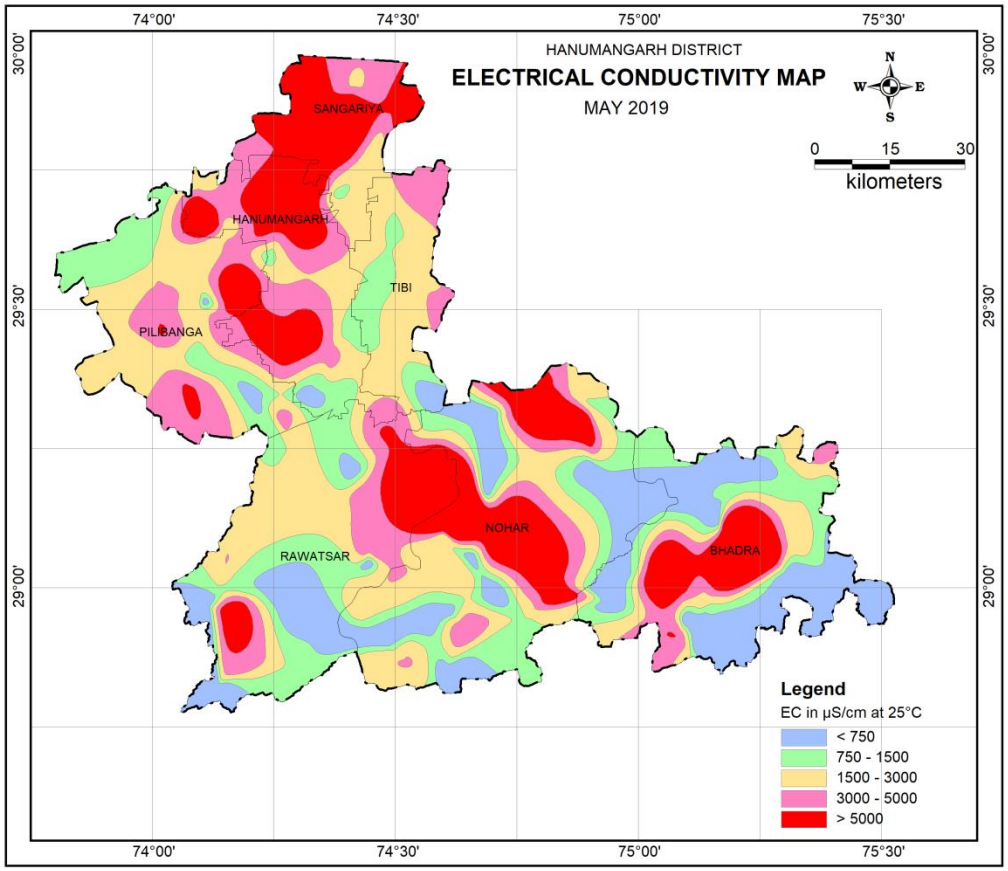
3. Ground water quality issues

a) Salinity

The electrical conductivity value of ground water in Hanumangarh district found to vary from 240 to 41830 µS/cm at 25°C.and almost all block have ground water salinity issues which ultimately diminish the furtility of soil and yield.

b) High concentration of NO_3& SO_4

Due to shallow ground water level nitrate concentration and sulfate concentration has significantly increases in the all part of district nearly 28 % of samples have high nitrate value viz > 45 mg/L whereas35 % of samples have high sulfate i.e /.> 400 mg/L..



8.2 Ground Water Management Plan

In order to manage the ground water resources for sustanble development following management stratigies have been advocated which is as follows.

Ground water conservation measures:

The district has huge area however most of the area has saline ground water which is predominantly brakish to saline in nature. In most of the part of the district mainly traditional ground water conservation measures may be taken into account like tanka. The details of tanka along with tanka no is furnished in table below

Rain water may be collected in community tanka of 26836.3 of 50000 litter capacity of each tanka which decreases the dependency of available water.

Table 8.1: Area wise distribution of saline and fresh ground water

Block	Geographical Area of Block (sq km)	Potential Area (sq km)	Volume of sub surface storage space available (50% of unsaturated thickness) for artificial recharge (MCM)	Surface water Surplus (mcm)	Rainwater runoff (Geo area*Rainfall*25 %) (mcm)	Annual Extractable Ground Water (ham)	Current annual gross ground water extraction for 'All Uses' (ham)	Resource surplus	Category	No. of households	Tanka (Nos.) (Capacity 50,000 liters)
Bhadra	1776.8	158.10	90.57	0.00	184	2461.04	1506.09	954.95	Safe	48532	4853
Hanumangarh	1112.38	245.21	235.77	0.00	74	3447.55	2353.68	1093.88	Safe	44089	4409
Nohar	2439.45	57.10	50.05	0.00	201	886.44	545.67	340.77	Safe	49292	4929
Pilibanga	1128.02	392.24	476.76	0.00	75	4186.72	2912.09	1274.63	Safe	41198	4120
Rawatsar	1672.25	0.00	0.00	0.00	111			0.00	Saline	30516	3052
Sangaria	693.19	180.76	125.39	0.00	46	3768.53	2299.11	1469.42	Safe	23334	2333
Tibbi	757.51	245.09	37.35	0.00	50	4297.18	2784.39	1512.79	Safe	31401	3140
District	9579.6	1278.5	1015.887	0	740.6502	19047.46	12401.02	6646.438	0	268362	26836.2

Ground water development:

Table 8.2: GW structure to be constructed to increase Ground water development.

S.No.	Potential Zone	Aquifer	Annual Irrigation withdrawal (ha.m)	No. of wells in use	No. of Irrigation days	Unit Draft (M3/day)	Normalized Unit Draft (M3/day)	Total Withdrawal (mcm)	Total pumpage (ha.m)	Existing TW /DCB	To be constructed (DBW)	Total Stucture
BLOCK : BHADRA												
1	"ALO 1"[C]	Younger Alluvium	Without pump						1269.84			
			DCB/Tubewell	528	130	250	185	12.6984		528	72	600
2	"ALO 1 (S)"[	Younger Alluvi	Without pump						1526.472			

	C]	um										
			DCB/Tubewell	1146	90	200	148	15.26472		1146	254	1400
BLOCK : HANUMANGARH												
1	"ALO 1a"[C]	Younger Alluvium	Without pump	5	120	20	14.6	0.00876	2204.929	5	5	10
			DCB/Tubewell	929	130	250	182.5	22.04053		929	21	950
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	16	90	20	14.6	0.021024	2984.225	16	16	32
			DCB/Tubewell	2670	90	170	124.1	29.82123		2670	0	2670
BLOCK : PILIBANGA												
1	"ALO 1a"[C]	Younger Alluvium	Without pump	4	120	20	14.6	0.007008	2719.586	4	4	8
			DCB/Tubewell	1146	130	250	182.5	27.18885		1146	54	1200
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	13	90	20	14.6	0.017082	2547.123	13	13	26
			DCB/Tubewell	2279	90	170	124.1	25.45415		2279	21	2300
BLOCK : SANGARIA												
1	"ALO 1a"[C]	Younger Alluvium	Without pump	3	120	20	27	0.00972	1046.952	3	3	6
			DCB/Tubewell	298	130	200	270	10.4598		298	52	350
	"ALO 1b"[C]	Younger Alluvium	Without pump	-	-	-			1179.36	-		
			DCB/Tubewell	336	130	200	270	11.7936		336	64	400
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	8	90	20	27	0.01944	3317.072	8	8	16
			DCB/Tu	1605	90	170	229.5	33.15		160	95	1700

			bewell					128		5		
BLOCK : TIBBI												
1	"ALO 1a"[C]	Younger Alluvium	Without pump	3	120	20	17.8	0.006408	2644.386	3	3	6
			DCB/Tubewell	914	130	250	222.5	26.43745		914	0	914
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	8	90	20	17.8	0.012816	2253.533	8	8	16
			DCB/Tubewell	1654	90	170	151.3	22.52252		1654	0	1654
BLOCK : RAWATSAR												
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	4	90	20	20.6	0.007416	2339.563	4	4	8
			DCB/Tubewell	1682	90	150	154.5	23.38821		1682	18	1700
4	"ALO 3 (S)"[C]	Older Alluvium	Without pump	-	-	-		-	673.002	-		
			DCB/Tubewell	484	90	150	154.5	6.73002		484	16	500
BLOCK : NOHAR												
1	"ALO 1"[C]	Younger Alluvium	Without pump	4	120	20	13.2	0.006336	531.696	4	4	8
			DCB/Tubewell	447	120	150	99	5.31036		447	53	500
2	"ALO 1 (S)"[C]	Younger Alluvium	Without pump	3	90	20	13.2	0.003564	1370.714	3	3	6
			DCB/Tubewell	1538	90	150	99	13.70358		1538	162	1700
District				17727	2760	3100	2791.5	286.0843	27338.59	17727	953	18680

953 nos of DCB may be constructed to increase the ground water development.

By applying above proposed intervention stage of ground water would be changeed as per table

Table 8.3: GW structure to be constructed to increase gw development.

Block	Prior to intervention				Post intervention		
	Annual Extractable Ground Water (ham)	Current annual gross ground water extraction for 'All Uses' (ham)	Resource surplus	Category	Stage of GW Development	Current annual gross ground water extraction for 'All Uses' (ham)	Stage after inervention
Bhadra	2461.04	1506.09	954.9504	Safe	61.19729	1679.25	68.23334
Hanumangarh	3447.554	2353.679	1093.875	Safe	68.27098	2403.5	69.7161
Nohar	886.438	545.6696	340.7684	Safe	61.55756	608.63	68.66019
Pilibanga	4186.718	2912.086	1274.632	Safe	69.55534	2800	66.87817
Rawatsar			0	Saline		3069.64	saline
Sangaria	3768.534	2299.112	1469.422	Safe	61.00813	2500	66.3388
Tibbi	4297.177	2784.386	1512.791	Safe	64.7957	3033.14	70.58449
District	19047.46	12401.02	6646.438	0	65.10591	16094.16	84.49505

Increase in irrigation area:

Table 8.4:Irrigation area to increase for increase in production

Sr. No	Block	Geographical Area of Block (sq km)	Potential Area (sq km)	Saline area (sq km)	% Availability of of Fresh ground water area	%Availability of of Saline ground water area	Total irrigated area(Sq km)	% of Irrigated area	Increase in 10 % of total irrigated area(sq km)	% of Irrigated area
1	Bhadra	1776.8	158.1	1618.7	8.898019	91.10198	50.22	2.82643	55.242	3.109072
2	Hanuma	1112.38	245.2	867.	22.043	77.9562	964.6	86.71	1061.	95.39

	ngarh		1	17	73	7	5	947	115	141
3	Nohar	2439.45	57.1	2382.35	2.340692	97.65931	543.48	22.27879	597.828	24.50667
4	Pilibanga	1128.02	392.24	735.78	34.77243	65.22757	726.12	64.3712	798.732	70.80832
5	Rawatsar	1672.25	0	1672.25	0	100	650.3	38.88773	715.33	42.7765
6	Sangaria	693.19	180.76	512.43	26.07654	73.92346	563.66	81.31393	620.026	89.44532
7	Tibbi	757.51	245.09	512.42	32.35469	67.64531	612.03	80.79497	673.233	88.87447
8	District	9579.6	1278.5	8301.1	13.34607	86.65393	4110.46	42.90847	4521.506	47.19932

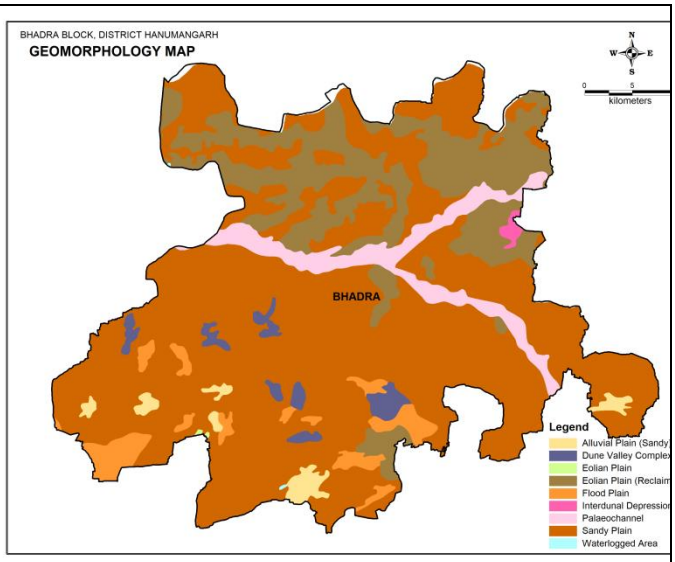
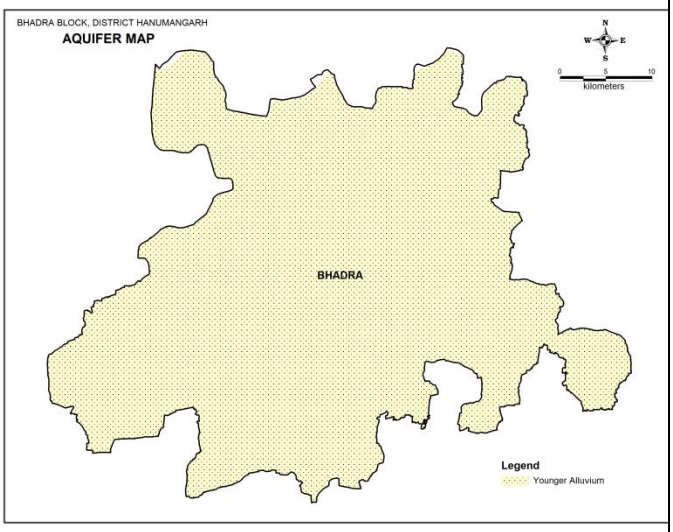
Horticulture: The majorportion of district has saline area so horticulture may be adopted specially solt tolerant crops can be sown viz Jeera, Palm granets,Potato etc.

Conjunctive Use: Due to availability of large quantuam of surface ground water lground water may beblended with canal water.

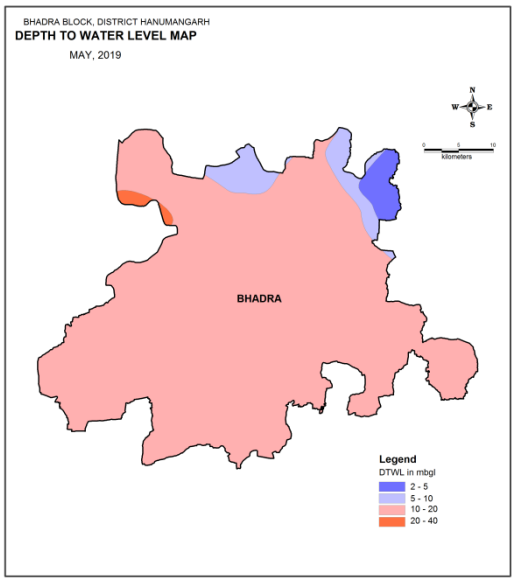
BLOCK-WISE AQUIFER MAPS AND MANAGEMENT PLANS

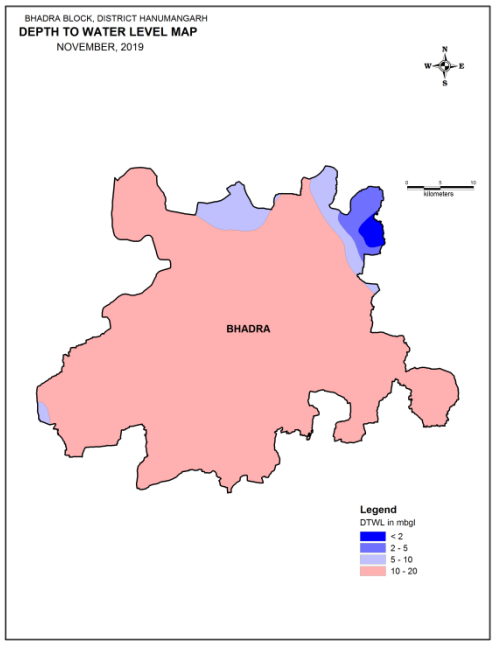
- BhadraBLOCK
- HanumangarhBLOCK
- Rawatsar BLOCK
- Nohar BLOCK
- PilibangaBLOCK
- Tibbi BLOCK
- Sangariya Block

SALIENT INFORMATION	**BHADRA**	
Block Name	**BHADRA**	
Longitude	74°51'46.8" and 75°29'16.8" East	
Latitude	28°49'40.8" and 29°14'49.2" North	
Geographical Area sq.km	1737.3	
Population (2011)	249656	
Climate	Aird, Extreem hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	376	
Mean Annual rainfall (mm)	363.6458333	
Highest annual rainfall (mm) with year	679(1975)	
Lowest annual rainfall (mm) with year	106(2000)	
Standard deviation (mm)	139.7543924	
Coefficient of Variation (%)	38.43145709	
Drought Analysis	No of Years of Drought	No of Years of Drought
Mild (0 to -25%)	11	11
Normal (-25% to -50%)	9	9
Severe (-50% to -75%)	6	6
Most severe (-75% to -100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-AlongGhaggar river	
	β) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	

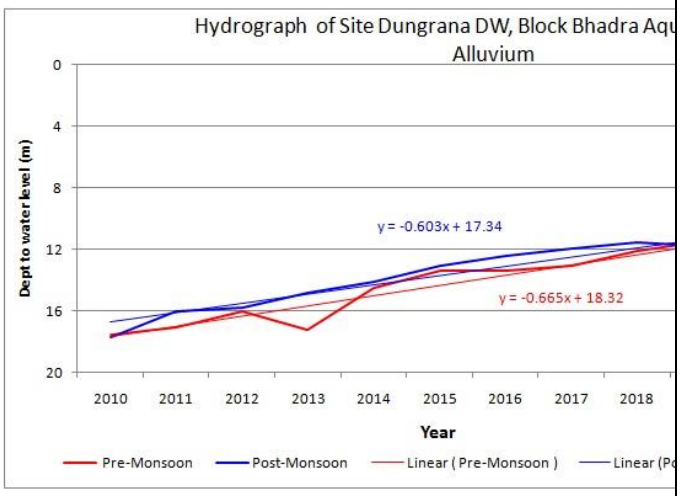
	
Elevation (m amsl)	189.4 to 225.4
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age:Recent to Sub-recent • Alluvium, isolated calcareous and sediments with gypsum bed, Age:Quaternary • Sand stone poorly cemented,with verigated clay Age:Tertiary 
Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE,	

IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	173690
Forest Area in ha.	2729
Net Sown Area in ha.	158734
Area sown more than once in ha.	113917
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat
Area under Irrigation (Net) in ha	82684
Surface Water	80455
Ground Water	1961
Other sources	268
Contribution of Surface Water %	97.30419428
Contribution of Ground Water %	2.695805718
Principal Crops	
Crop Type Wheat	16200
Barley	397
Gram	38103
Sarso	14065
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	4
SGWD	17
NAQUIM Key Wells	25

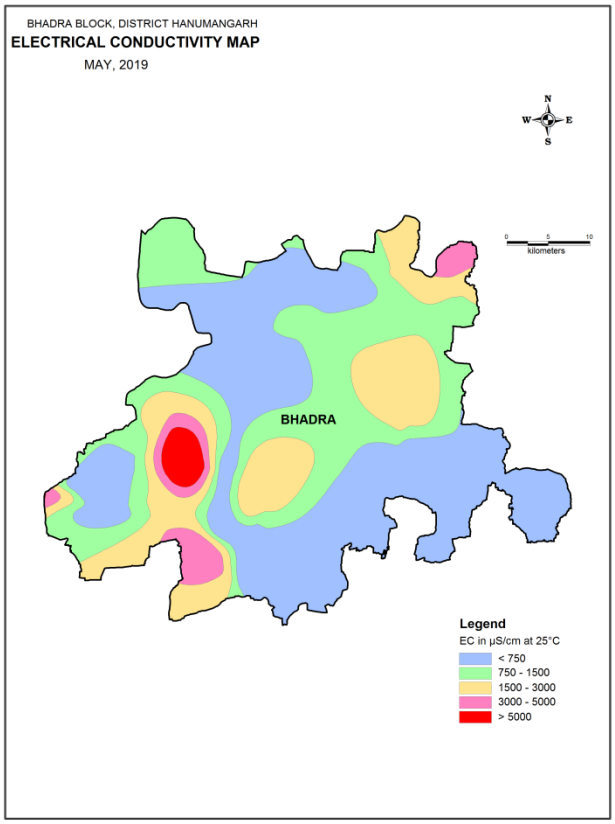




WATER LEVEL BEHAVIOUR	Pre Monsoon	Post Monsoon
	(May-2019	(November-2019)
Water Level (m bgl)	3.22 - 18.15	1.61 - 17.59
Water Level Trend (2010-2019)	Pre Monsoon	Post Monsoon
Average Trend (m/year)	2.8	1.11



	Pre Monsoon	Post Monsoon
Rise	(-14.4) - (-0.53)	(-9.8) -(-0.68)
Fall	0.18 - 8.33	0.009 - 11.75
AQUIFER DISPOSITION		
Number of Aquifers (Major)	Two	

I	Alluvium		
II	Alluvium& Tertiary		
Status of GW Exploration	CGWB	GWD	
	6	5	
BASIC AQUIFER CHARACTERISTICS			
Type of Aquifer	Phreatic	Semi confined	
Depth of Occurrence (mbgl)	50 - 100	110 -150	
Yield Potential	500	300 -700	
Specific Yield (Sy)	0.015		
Transmissivity (T)			
CHEMICAL QUALITY OF GROUND WATER			
Electrical ConductivityµS/cm at 25°C	300 - 30000		
pH	7.2 -8.42		
Suitability for Drinking			
TDS	**Range**	**% Samples**	
Fresh	0-3000	80	
Brackish	>-3000	20	

Hardness	**Range**	**% Samples**
Soft	0 – 75	0
Moderately Hard	75 – 150	4
Hard	150 – 300	52
Very Hard	>300	44
NO3 in mg/l>45 mg/l	permissible limit	8
F in mg/l – 1 to 1.5 mg/l	Between DL & PL	4
>1.5 mg/l	> Permissible limit	0

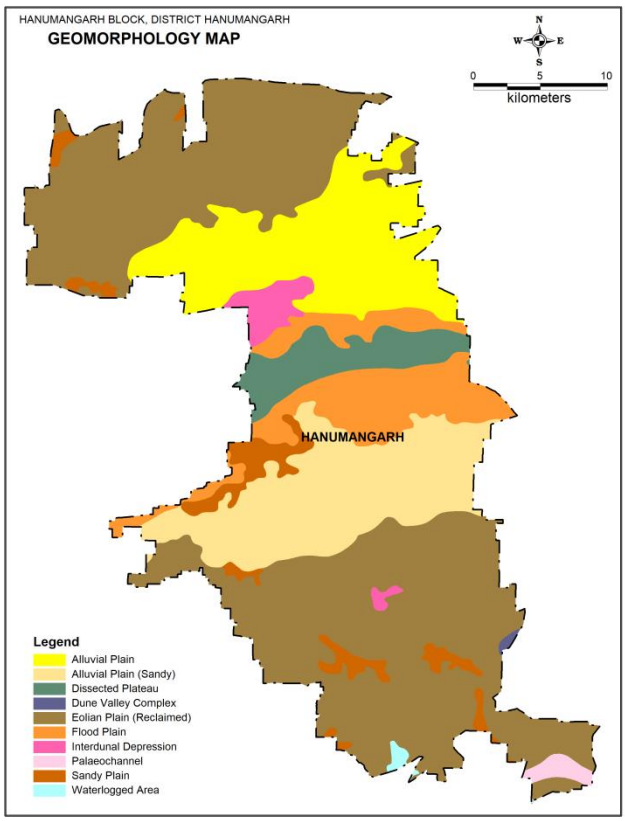
Suitability for Irrigation				
EC				
Type of Water	**Classification**	% Samples	RSC(meq/L)	% Samples
			< 1.25	92
Low Saline< 250 mg/l	Excellent	0	1.25 -2.0	4
Medium Saline 250–750 mg/l	Good	56	2.0 -2.5	0
Highly Saline 750 –2250 mg/l	Permissible	20	2.5-3.0	0
Very Highly saline>2250 mg/l	Doubtful	24	> 3.0	4

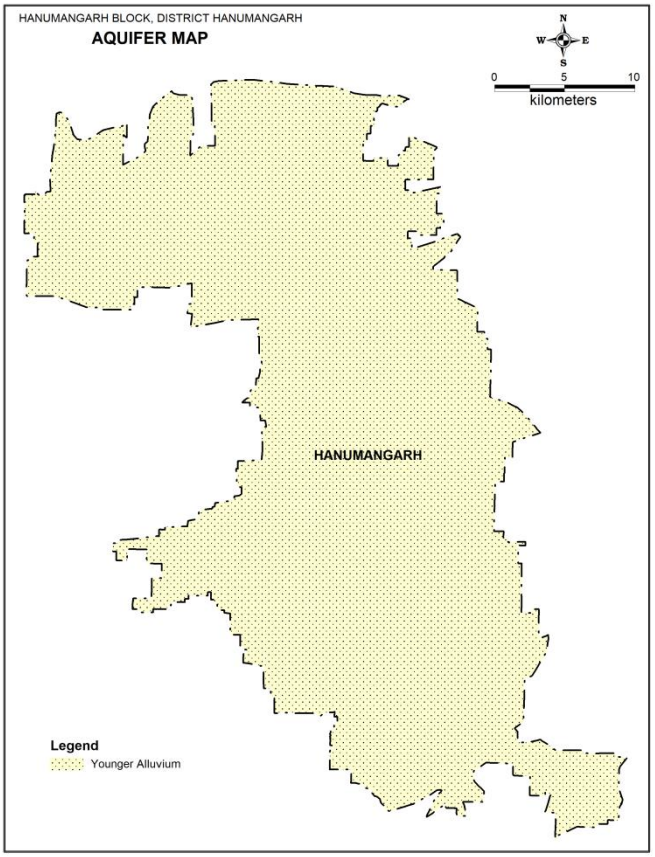
Na%			SAR		
Water Class	**Range**	% Samples	Water class	Range	% samples
Excellent	< 20	32	Water class		
Good	20 - 40	28	Excellenet	< 10	76
Medium	40 - 60	8	Good	10 to 18	12
Bad	60 - 80	32	Medium	18 to 26	8
Very Bad	> 80	0	Bad	> 26	4
GROUND					

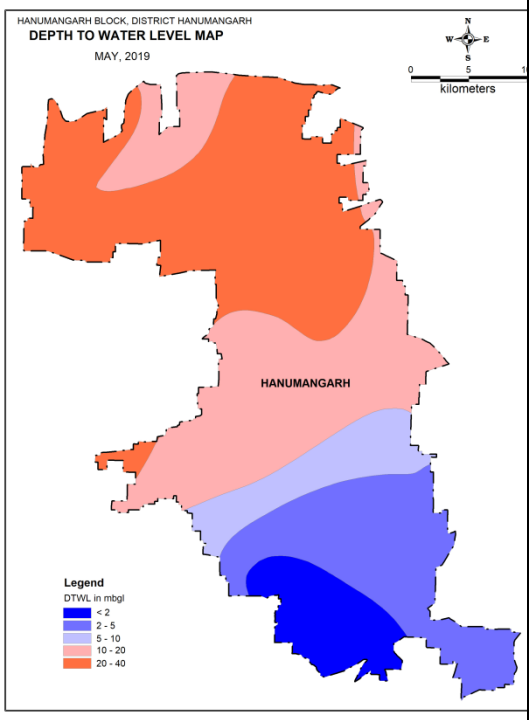
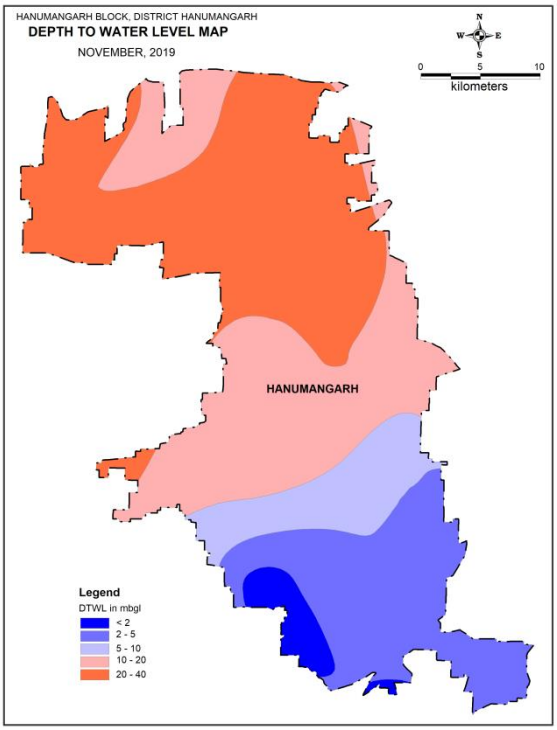
WATER ISSUES		
1. Inland Salinity		Ground water salinity
Limited availablility of fresh GW		Limited availability of fresh water
		Water logging
		Ground water contamination
3. Rainfall and Drought		· Mild Droughts in 33% years
		Normal Droughts in 12% years
		Severe Drought in 10% years
GROUND WATER RESOURCE & EXTRACTION		
Ground Water Recharge Worthy Area (Sq. Km.)		158.1
Total Annual Ground Water Recharge (mcm)		25.905688
Natural discharge during non monsson season (mcm)		1.295284
Net Annual Ground Water Availability (mcm)		24.610404
Existing Gross Ground Water Draft for All uses(mcm)		15.0609
Provision for domestic and industrial requirement supply to 2025(mcm)		3.189375
Stage of Ground Water Development %		61.2
Category		SAFE
In-Storage Resource		
Total Area (Sq. km)		1737.3
Dynamic Resource (mcm)		24.6104
Utilizable Volume (mcm)		16.136
Total In-storage Resource (mcm)		382.6652
Total Resource Dynamic + In-storage		407.2756
Sustainability Period in years with existing draft		Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT		
Area identified for Artificial Recharge & Conservation		158.1
Existing Structures constructed by State Govt.		15
Anicut		0
Diggy/ jalhoj		7
Earthen Checkdam		0

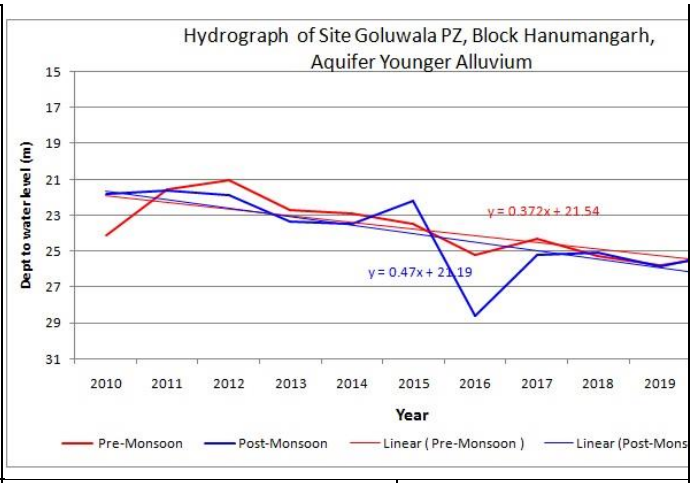
Johad		6
Mini Percolation tank		0
Minor Irrigation Tank		0
Recharge Shaft		0
Sub Surface barrier		0
Talai (Talab)		2
Water Harvesting Structure		0
Traditional Ground water conservation structures (Tanka) capacity of 50000lit		4853.2
No DCB		326
Prior to intervention	Annual Extractable Ground Water (ham)	2461.0404
	Current annual gross ground water extraction for 'All Uses' (ham)	1506.09
	Resource surplus (hem)	954.9504
	Category	Safe
Geographical Area of Block (sq km)		1776.8
Potential Area (sq km)		158.1
Saline area (sq km)		1618.7
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may be taken and used
% Availability of of Fresh ground water area		8.89801891
%Availability of of Saline ground water area		91.10198109
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerence crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		50.22
% of Irrigated area		2.826429536
Increase in 10 % of total irrigated area(sq km)		55.242
% of Irrigated area		3.10907249
Expected Benefits		
Post intervention	**Stage of GW Development**	**61.19728876**
	Current annual gross ground water extraction for 'All Uses' (ham)	**1679.25**
	Stage after intervention	**68.23333741**
	Category	**Safe**

SALIENT INFORMATION	**HANUMAN GARH**	
Block Name	**HANUMAN GARH**	
Longitude	74°03'32.4" and 74°31'55.2" East	
Latitude	29°17'13.2" and 29°44'06" North	
Geographical Area sq.km	1273.1	
Population (2011)	234649	
Climate	Arid, Extreme hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	263	
Mean Annual rainfall (mm)	250.9714286	
Highest annual rainfall (mm) with year	547(2010)	
Lowest annual rainfall (mm) with year	75.5(1974)	
Standard deviation (mm)	111.8677437	
Coefficient of Variation (%)	44.57389606	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	8	16.32653061
Normal (-25% to -50%)	6	12.24489796
Severe (-50% to -75%)	9	18.36734694
Most severe (-75% to -100%)	0	0
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-AlongGhaggar river	
	β) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	

	
Elevation (m amsl)	169 to 209.1
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age:Recent to Sub-recent
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age:Quaternary
	• Sand stone poorly cemented,with verigated clay Age:Tertiary

	
Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	Ghaggar
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	123125
Forest Area in ha.	3092
Net Sown Area in ha.	103420
Area sown more than once in ha.	93549
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat
Area under Irrigation (Net) in ha	187553
Surface Water	187553

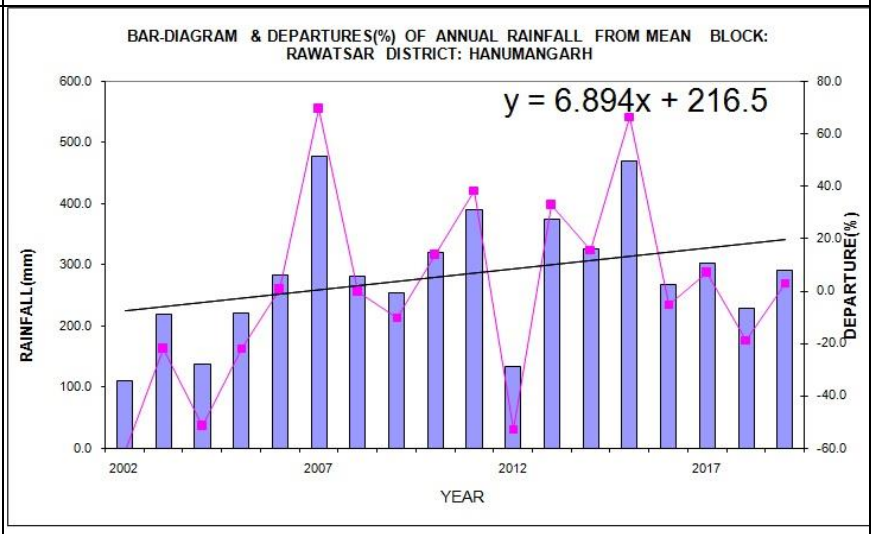
Ground Water	0	
Other sources	0	
Contribution of Surface Water %	100	
Contribution of Ground Water %	0	
Principal Crops		
Crop Type Wheat	66618	
Barley	2192	
Gram	2681	
Sarso	23406	
Hydrogeology		
Monitoring Stations (May 2019)		
CGWB	10	
SGWD	16	
NAQUIM Key Wells	39	
WATER LEVEL BEHAVIOUR	Pre Monsoon	Post Monsoon
	(May-2019	(November-2019)
		
Water Level (m bgl)	1.72 - 28.59	1.16 - 31.46
Water Level Trend (2010-2019)	Pre Monsoon	Post Monsoon
Average Trend (m/year)	1.2	1.21
	Pre Monsoon	Post Monsoon

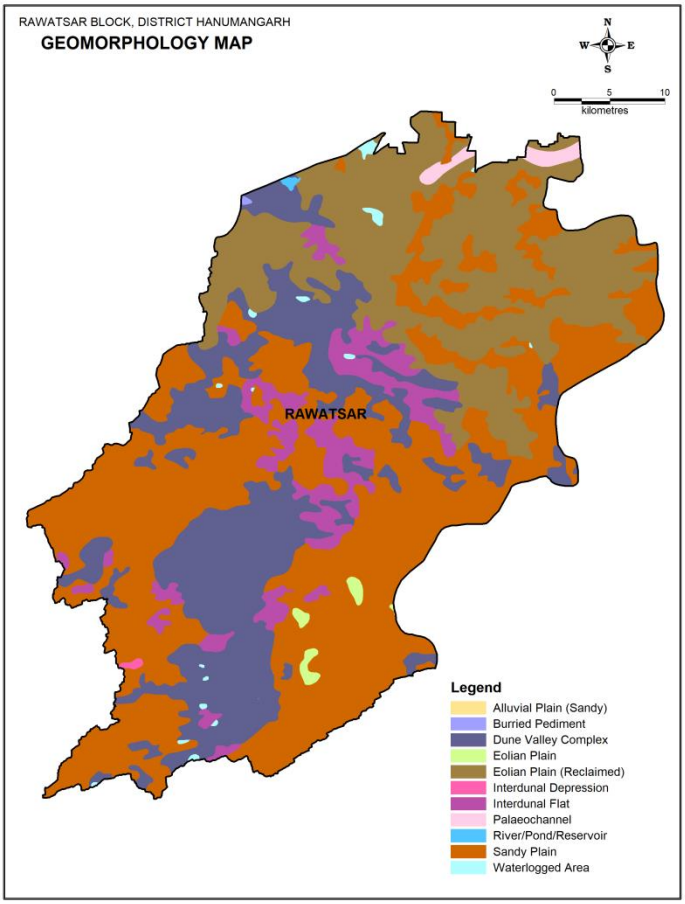
			
	Rise	(-5.74) -(-0.08)	(-7.8) -(-0.07)
	Fall	0.007 - 4.00	0.07 -5.29
AQUIFER DISPOSITION			
Number of Aquifers (Major)		Two	
I		Alluvium	
II		Alluvium& Tertiary	
Status of GW Exploration		CGWB	GWD
		21	14
BASIC AQUIFER CHARACTERISTICS			
Type of Aquifer		Phreatic	Semi confined
Depth of Occurrence (mbgl)		50 - 100	150 -200
Yield Potential		700	175-1100
Specific Yield (Sy)		0.015	
Transmissivity (T)		604	
CHEMICAL QUALITY OF GROUND WATER			
Electrical ConductivityµS/cm at 25°C		260 - 8190	
pH		7.34-8.93	
Suitability for Drinking			
TDS	**Range**	**% Samples**	
Fresh	0-3000	76.92	
Brackish	>-3000	23.07	
Hardness	**Range**	**% Samples**	
Soft	0 – 75	0	
Moderately Hard	75 – 150	10.25	
Hard	150 – 300	23.07	
Very Hard	>300	66.66	
NO3 in mg/l>45	permissible limit	31	

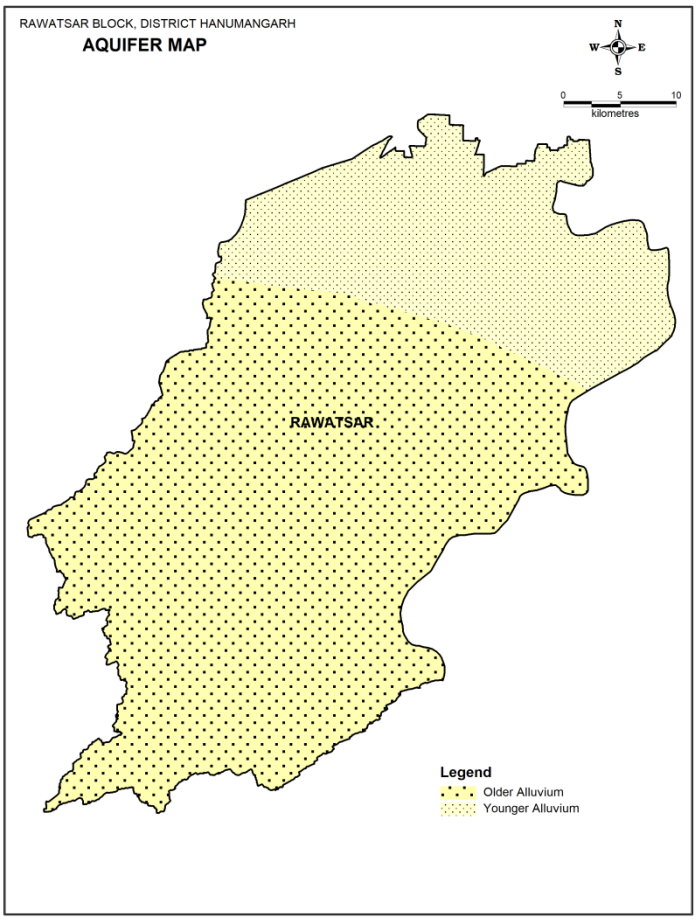
mg/l					
F in mg/l – 1 to 1.5 mg/l	Between DL & PL		15		
>1.5 mg/l	> Permissible limit		31		
Suitability for Irrigation					
EC					
Type of Water		**Classification**	% Samples	RSC(meq/L)	% Samples
				< 1.25	84.61
Low Saline< 250 mg/l		Excellent	0	1.25 -2.0	0
Medium Saline 250–750 mg/l		Good	12.82	2.0 -2.5	0
Highly Saline 750 –2250 mg/l		Permissible	38.46	2.5-3.0	0
Very Highly saline>2250 mg/l		Doubtful	48.71	> 3.0	15.83
Na%				SAR	
Water Class	**Range**	% Samples	Water class	Range	% samples
Excellent	< 20	5.128205	Water class		
Good	20 - 40	35.89744	Excellenet	< 10	82.05
Medium	40 - 60	23.07692	Good	10 to 18	12.82
Bad	60 - 80	23.07692	Medium	18 to 26	5.12
Very Bad	> 80	12.82051	Bad	> 26	0
GROUND WATER ISSUES					
1. Inland Salinity			Ground water salinity		
Limited availablility of fresh GW			Limited availability of fresh water		
			Water logging		
			Ground water contamination		
3. Rainfall and Drought			· Mild Droughts in 16% years		
			Normal Droughts in 12% years		

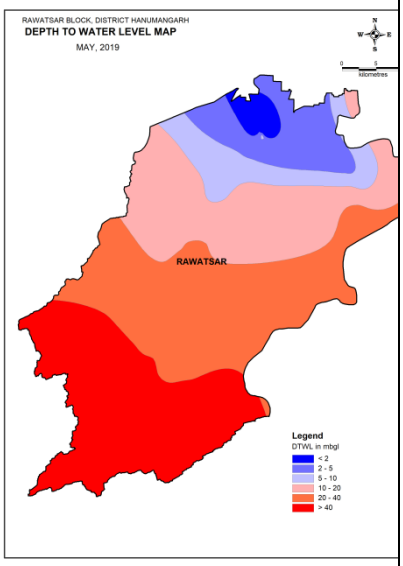
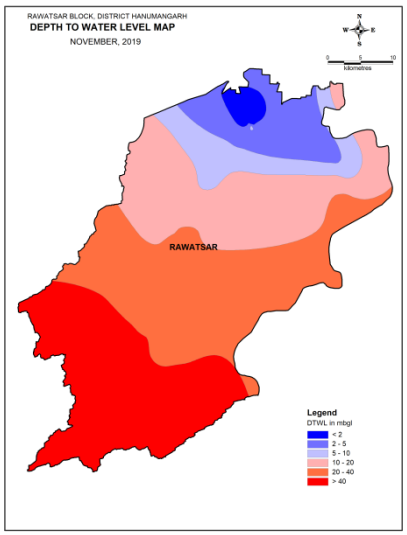
	Severe Drought in 18 % years
GROUND WATER RESOURCE & EXTRACTION	
Ground Water Recharge Worthy Area (Sq. Km.)	245.21
Total Annual Ground Water Recharge (mcm)	38.30615
Natural discharge during non monsson season (mcm)	3.830615
Net Annual Ground Water Availability (mcm)	34.475535
Existing Gross Ground Water Draft for All uses(mcm)	23.536785
Provision for domestic and industrial requirement supply to 2025(mcm)	2.008125
Stage of Ground Water Development %	68.27
Category	SAFE
In-Storage Resource	
Total Area (Sq. km)	1273.1
Dynamic Resource (mcm)	34.4755
Utilizable Volume (mcm)	10.536
Total In-storage Resource (mcm)	387.5299
Total Resource Dynamic + In-storage	422.0054
Sustainability Period in years with existing draft	Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT	
Area identified for Artificial Recharge & Conservation	245.12
Existing Structures constructed by State Govt.	14
Anicut	0
Diggy/ jalhoj	8
Earthen Checkdam	0
Johad	0
Mini Percolation tank	0
Minor Irrigation Tank	0
Recharge Shaft	6
Sub Surface barrier	0
Talai (Talab)	0
Water Harvesting Structure	0
Traditional Ground water	4408.9

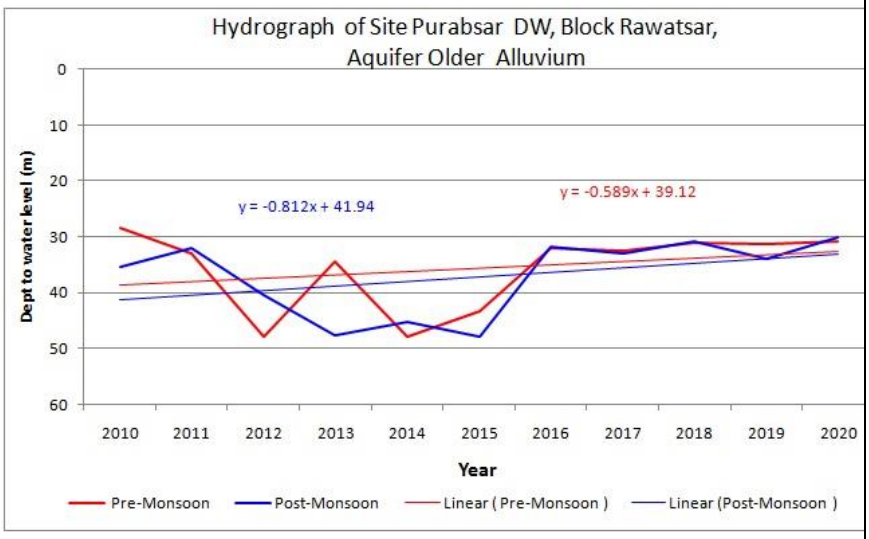
conservation structures (Tanka) capacity of 50000lit		
No DCB		21
Prior to intervention	Annual Extractable Ground Water (ham)	3447.5535
	Current annual gross ground water extraction for 'All Uses' (ham)	2353.6785
	Resource surplus (hem)	1093.875
	Category	Safe
Geographical Area of Block (sq km)		1112.38
Potential Area (sq km)		245.21
Saline area (sq km)		867.17
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may be taken and used
% Availability of of Fresh ground water area		22.04372606
%Availability of of Saline ground water area		77.95627394
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerance crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		964.65
% of Irrigated area		86.71946637
Increase in 10 % of total irrigated area(sq km)		1061.115
% of Irrigated area		95.39141301
Expected Benefits		
Post intervention	**Stage of GW Development**	**68.27**
	Current annual gross ground water extraction for 'All Uses' (ham)	**2403.5**
	Stage after intervention	**69.71**
	Category	**Safe**

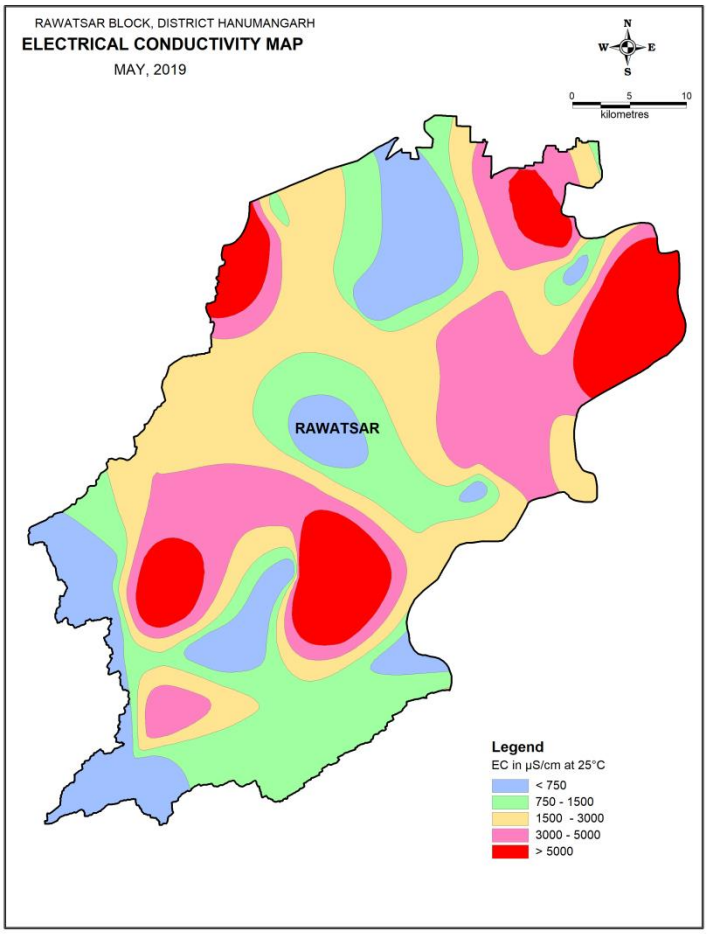
SALIENT INFORMATION	**RAWATSAR**	
Block Name	**RAWATSAR**	
Longitude	74°07'33.6" and 74°39'50.4" East	
Latitude	28°44'27.6" and 29°20'38.4" North	
Geographical Area sq.km	1768.2	
Population (2011)	169991	
Climate	Arid, Extreme hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	289	
Mean Annual rainfall (mm)	282.0555556	
Highest annual rainfall (mm) with year	477(2007)	
Lowest annual rainfall (mm) with year	109(2002)	
Standard deviation (mm)	103.4871246	
Coefficient of Variation (%)	36.69033373	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	6	33.33333333
Normal (-25% to -50%)		0
Severe (-50% to -75%)	2	11.11111111
Most severe (-75% to -		

100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-Along Ghaggar river	
	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	
		
Elevation (m amsl)	170.7 to 239	
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age: Recent to Sub-recent	
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age: Quaternary	
	• Sand stone poorly cemented, with variegated clay Age: Tertiary	

Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	187827
Forest Area in ha.	5797
Net Sown Area in ha.	162339
Area sown more than once in ha.	115430
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat

Area under Irrigation (Net) in ha	121022
Surface Water	108873
Ground Water	12149
Other sources	0
Contribution of Surface Water %	89.96132935
Contribution of Ground Water %	10.03867065
Principal Crops	
Crop Type Wheat	24845
Barley	1617
Gram	9329
Sarso	26122
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	11
SGWD	5
NAQUIM Key Wells	34
WATER LEVEL BEHAVIOUR	 
	Pre Monsoon
	(May-2019
Water Level (m bgl)	1.35 -42.14

Water Level Trend (2010-2019)		
Average Trend (m/year)	0.84	
	Pre Monsoon	
Rise	(-5.54) -(- 0.05)	
Fall	0.09 - 2.42	
AQUIFER DISPOSITION		
Number of Aquifers (Major)		
I	Alluvium	
II	Alluvium& Tertiary	
Status of GW Exploration	CGWB	GWD
	2	0
BASIC AQUIFER CHARACTERISTICS		
Type of Aquifer	Phreatic	Semi confined
Depth of Occurrence (mbgl)	50 - 100	110 -150
Yield Potential	165 - 1000	100 - 2000
Specific Yield (Sy)	0.015	
Transmissivity (T)		

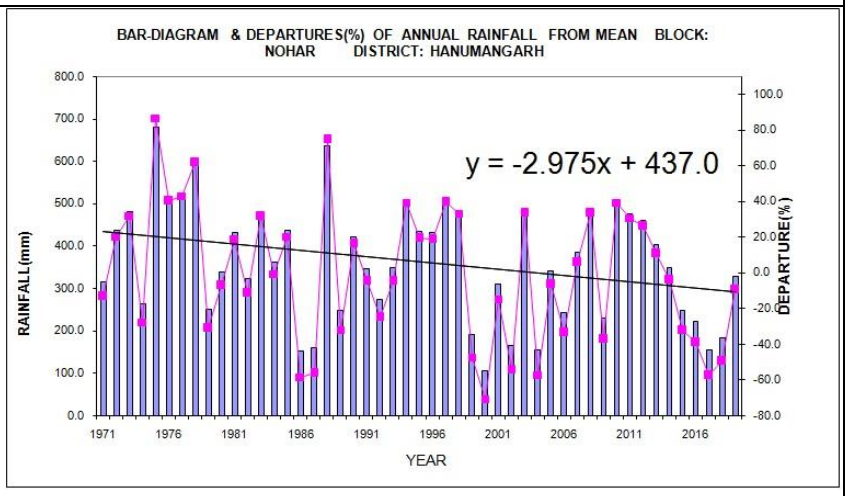
CHEMICAL QUALITY OF GROUND WATER		
Electrical ConductivityµS/cm at 25°C		260 - 14420
pH		1.54 -8.42
Suitability for Drinking		
TDS	**Range**	% Samples
Fresh	0-3000	85.29
Brackish	>-3000	14.7
Hardness	**Range**	% Samples
Soft	0 – 75	2.94
Moderately Hard	75 – 150	26.47
Hard	150 – 300	17.64
Very Hard	>300	50
NO3 in	permissible	62

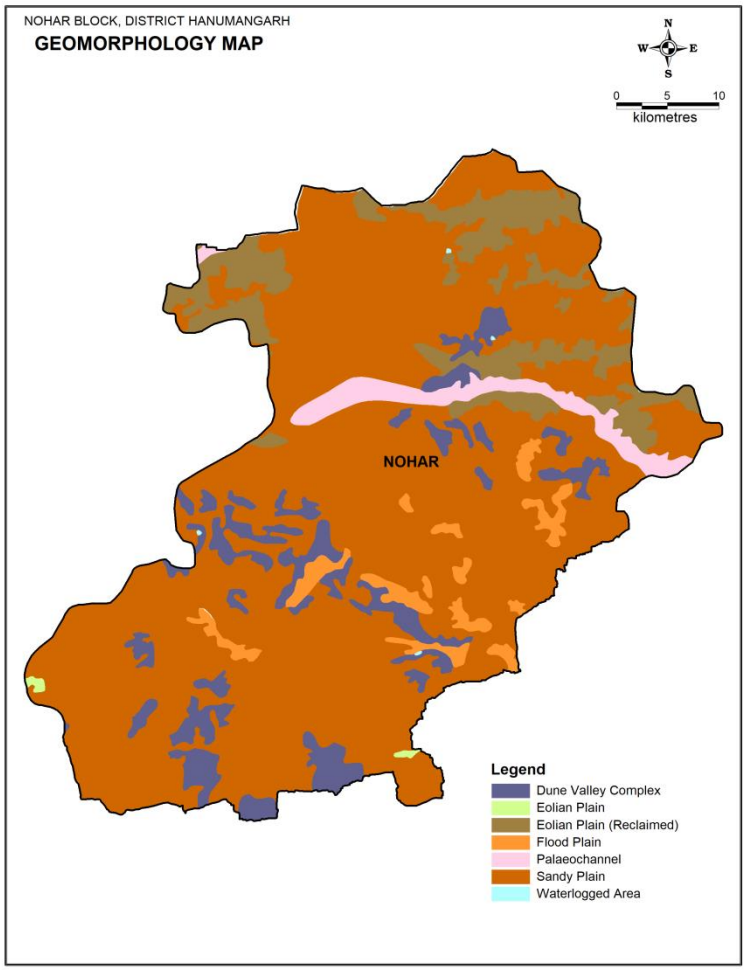
mg/l>45 mg/l	limit					
F in mg/l – 1 to 1.5 mg/l	Between DL & PL	3				
>1.5 mg/l	> Permissible limit	3				
Suitability for Irrigation						
EC						
Type of Water	**Classification**	% Samples	RSC(meq/L)	% Samples		
			< 1.25	78.78787879		
Low Saline< 250 mg/l	Excellent	0	1.25 -2.0	6.060606061		
Medium Saline 250–750 mg/l	Good	36.36364	2.0 -2.5	3.03030303		
Highly Saline 750 –2250 mg/l	Permissible	30.30303	2.5-3.0	0		
Very Highly saline>2250 mg/l	Doubtful	33.33333	> 3.0	12.12121212		
Na%			SAR			
Water Class	**Range**	% Samples	% Samples	Water class	Range	% samples
Excellent	< 20	5.128205	21.21212	Water class		
Good	20 - 40	35.89744	24.24242	Excellenet	< 10	81.81818
Mediu	40 - 60	23.07692	27.27273	Good	10 to 18	9.090909

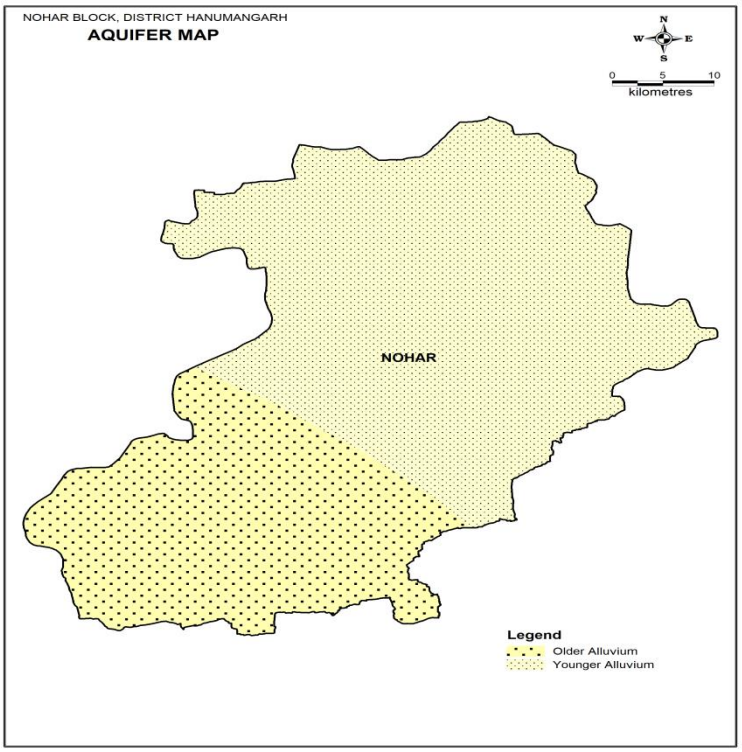
m						
Bad	60 - 80	23.07692	12.12121	Medium	18 to 26	9.090909
Very Bad	> 80	12.82051	15.15152	Bad	> 26	0
GROUND WATER ISSUES						
1. Inland Salinity			Ground water salinity			
Limited availablility of fresh GW			Limited availability of fresh water			
			Water logging			
			Ground water contamination			
3. Rainfall and Drought			Mild Droughts in 33% years			
			Normal Droughts in 00% years			
			Severe Drought in 11% years			
GROUND WATER RESOURCE & EXTRACTION						
Ground Water Recharge Worthy Area (Sq. Km.)			Saline			
Total Annual Ground Water Recharge (mcm)			120.952848			
Natural discharge during non monsson season (mcm)			12.095286			
Net Annual Ground Water Availability (mcm)			108.857562			
Existing Gross Ground Water Draft for All uses(mcm)			30.223646			
Provision for domestic and industrial			13.23			

requirement supply to 2025(mcm)	
Stage of Ground Water Development %	27.76
Category	Saline
In-Storage Resource	
Total Area (Sq. km)	1768.2
Dynamic Resource (mcm)	
Utilizable Volume (mcm)	
Total In-storage Resource (mcm)	
Total Resource Dynamic + In-storage	0
Sustainability Period in years with existing draft	Sustainble for long period of time
GROUND WATER RESOURCE ENHANCEMENT	
Area identified for Artificial Recharge & Conservation	0
Existing Structures constructed by State Govt.	40
Anicut	0
Diggy/ jalhoj	4
Earthen Checkdam	1
Johad	3
Mini Percolation tank	0
Minor Irrigation Tank	0
Recharge Shaft	0
Sub Surface barrier	0
Talai (Talab)	4
Water Harvesting Structure	28
Traditional Ground water conservation structures (Tanka) capacity of 50000lit	3051.6
No DCB	34
Pri Annual Extractable Ground Water (ham)	

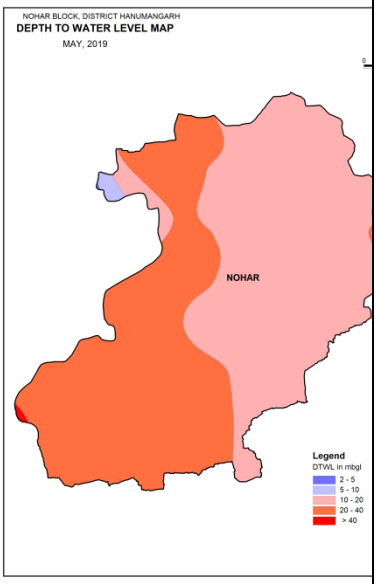
or to intervention	Current annual gross ground water extraction for 'All Uses' (ham)	
	Resource surplus (hem)	0
	Category	Saline
Geographical Area of Block (sq km)		1672.25
Potential Area (sq km)		0
Saline area (sq km)		1672.25
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may be taken and used
% Availability of of Fresh ground water area		0
%Availability of of Saline ground water area		100
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerance crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		650.3
% of Irrigated area		38.88772612
Increase in 10 % of total irrigated area(sq km)		715.33
% of Irrigated area		42.77649873
Expected Benefits		
Post intervention	**Stage of GW Development**	27 %
	Current annual gross ground water extraction for 'All Uses' (ham)	3069.64
	Stage after intervention	saline
	Category	Saline

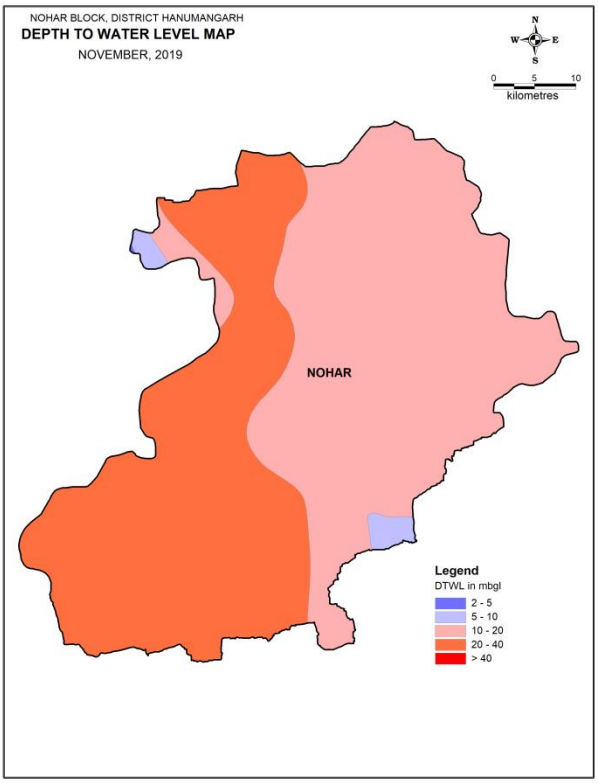
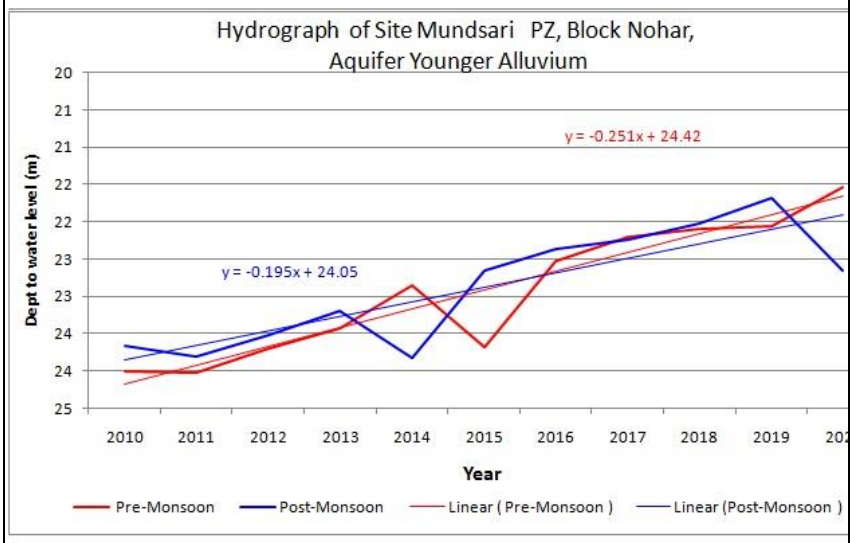
SALIENT INFORMATION	**NOHAR**	
Block Name	**NOHAR**	
Longitude	74°21'3.6" and 75°04'08.4" East	
Latitude	28°48'14.4" and 29°21'39.6" North	
Geographical Area sq.km	2432.9	
Population (2011)	264752	
Climate	Arid, Extreme hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	376	
Mean Annual rainfall (mm)	363.6458333	
Highest annual rainfall (mm) with year	679(1975)	
Lowest annual rainfall (mm) with year	106(2000)	
Standard deviation (mm)	139.7543924	
Coefficient of Variation (%)	38.43145709	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	11	22.44897959
Normal (-25% to -50%)	9	18.36734694
Severe (-50% to -75%)	6	12.24489796
Most severe (-75% to -100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-AlongGhaggar river	

	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts
	
Elevation (m amsl)	180.2 to 221.5
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age:Recent to Sub-recent
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age:Quaternary
	• Sand stone poorly cemented,with verigated clay Age:Tertiary

	
Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	246249
Forest Area in ha.	4469
Net Sown Area in ha.	220184
Area sown more than once in ha.	150452
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat

Area under Irrigation (Net) in ha	83514
Surface Water	83479
Ground Water	0
Other sources	35
Contribution of Surface Water %	99.95809086
Contribution of Ground Water %	0.041909141
Principal Crops	
Crop Type Wheat	12907
Barley	527
Gram	52986
Sarso	18390
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	4
SGWD	17
NAQUIM Key Wells	31
WATER LEVEL BEHAVIOUR	Pre Monsoon
	(May-2019

<table>
<tr><td></td><td> 


</td></tr>
<tr><td>Water Level (m bgl)</td><td>10.24 - 22.06</td></tr>
<tr><td>Water Level Trend (2010-2019)</td><td> 
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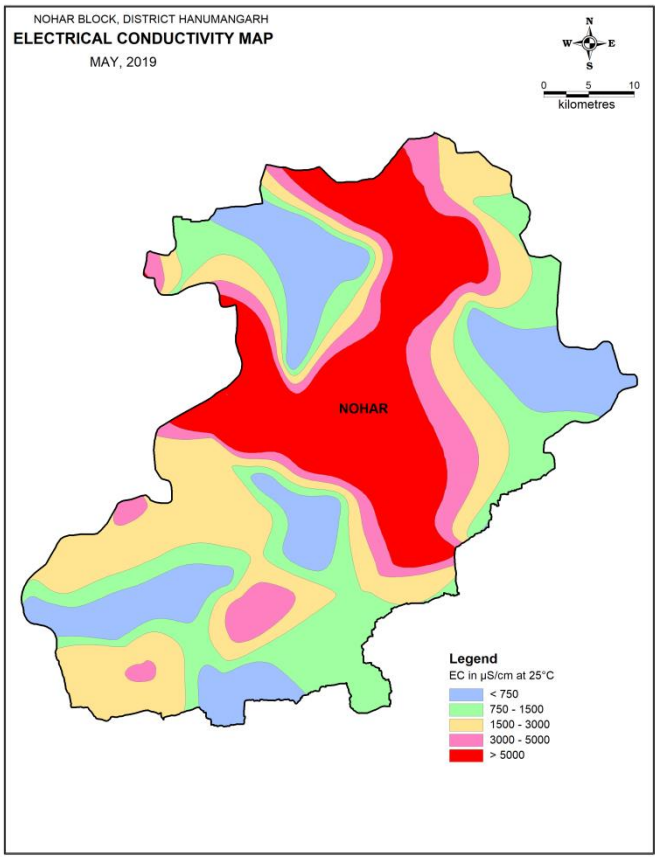
<tr><td>Average Trend (m/year)</td><td>1.69</td></tr>
<tr><td></td><td>Pre Monsoon</td></tr>
<tr><td>Rise</td><td>(-4.18) -(-0.11)</td></tr>
<tr><td>Fall</td><td>0.55 - 4.45</td></tr>
<tr><td>AQUIFER DISPOSITION</td><td></td></tr>
<tr><td>Number of Aquifers (Major)</td><td></td></tr>
</table>

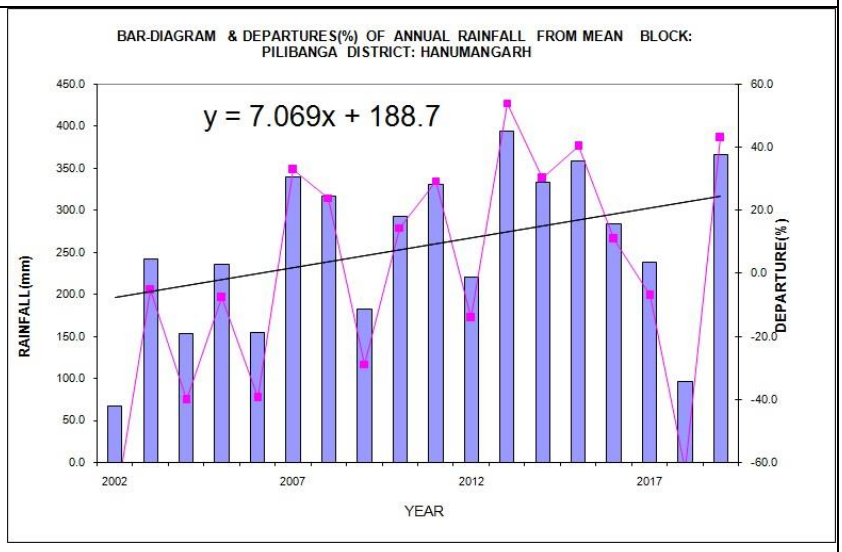
I	Alluvium	
II	Alluvium& Tertiary	
Status of GW Exploration	CGWB	GWD
	7	9
BASIC AQUIFER CHARACTERISTICS		
Type of Aquifer	Phreatic	Semi confined
Depth of Occurrence (mbgl)	50 - 100	110 -150
Yield Potential	100	350- 480
Specific Yield (Sy)	0.015	
Transmissivity (T)		
CHEMICAL QUALITY OF GROUND WATER		
Electrical ConductivityµS/cm at 25°C	240 - 41830	
pH	7.47 -8.48	
Suitability for Drinking		
TDS	**Range**	% Samples
Fresh	0-3000	77.41
Brackis	>-3000	22.58

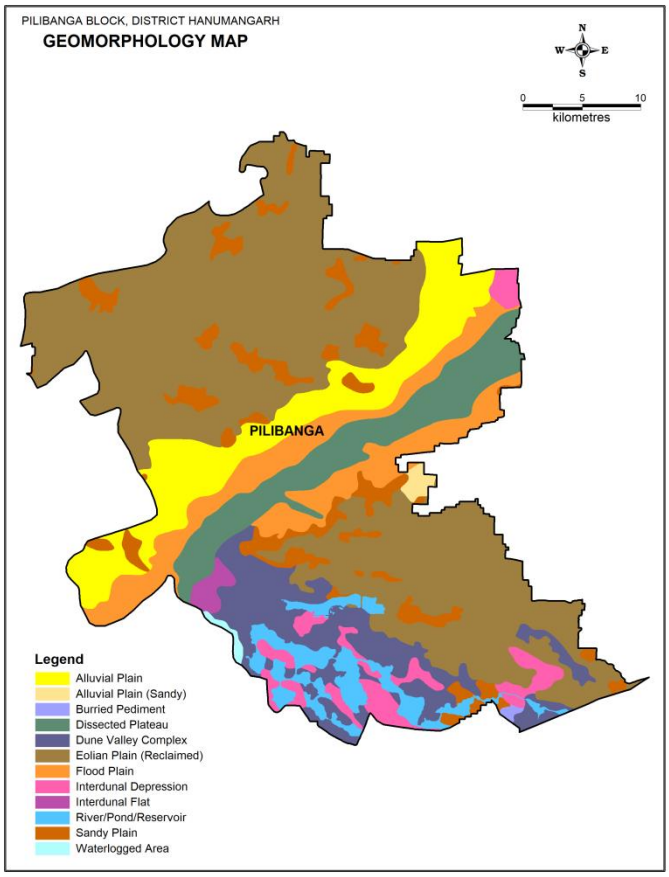
h						
Hardness	**Range**		% Samples			
Soft	0 – 75		3.22			
Moderately Hard	75 – 150		25.8			
Hard	150 – 300		16.12			
Very Hard	>300		54.83			
NO3 in mg/l>45 mg/l	permissible limit		35			
F in mg/l – 1 to 1.5 mg/l	Between DL & PL		3			
>1.5 mg/l	> Permissible limit		3			
Suitability for Irrigation						
EC						
Type of Water		**Classification**	% Samples	RSC(meq/L)	% Samples	
				< 1.25	87.09677419	
Low Saline< 250 mg/l		Excellent	6.451613	1.25 -2.0	0	
Medium Saline 250–750 mg/l		Good	32.25806	2.0 -2.5	6.451612903	
Highly Saline 750 –2250 mg/l		Permissible	19.35484	2.5-3.0	0	
Very Highly saline>2250 mg/l		Doubtful	41.93548	> 3.0	6.451612903	
Na%				SAR		
Water Class	**Range**	% Samples	% Samples	Water class	Range	% samples
Excellent	< 20	5.128205	25.80645	Water class		

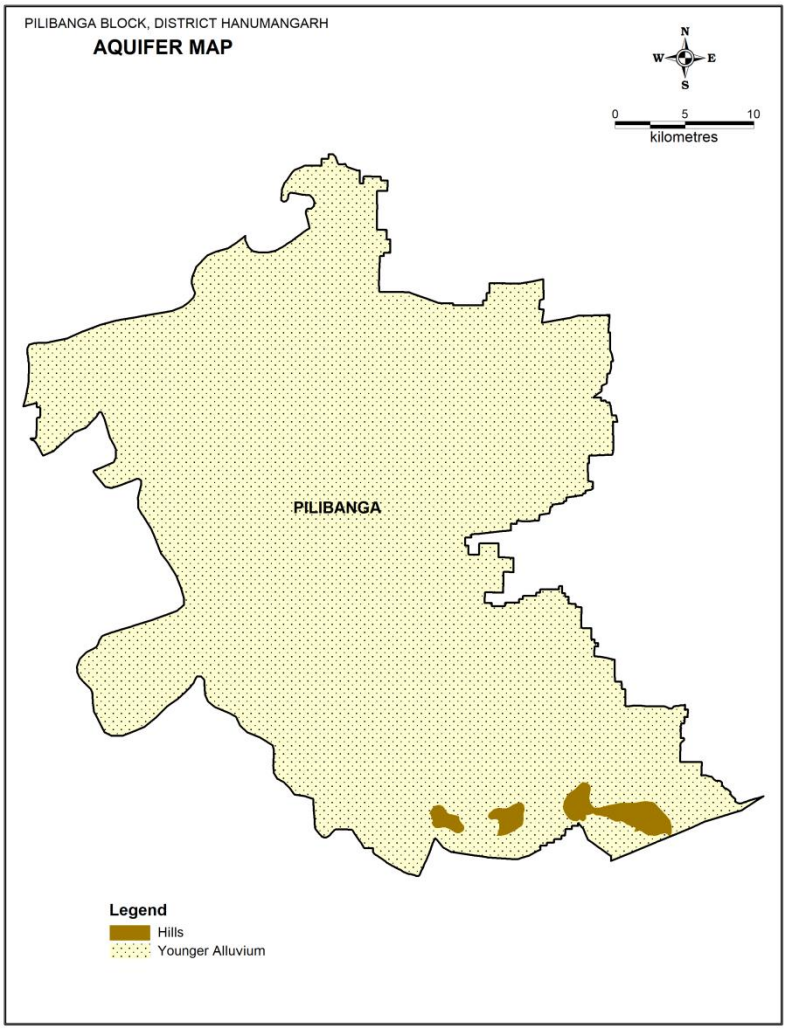
Good	20 - 40	35.89744	12.90323	Excellenet	< 10	80.64516
Medium	40 - 60	23.07692	29.03226	Good	10 to 18	6.451613
Bad	60 - 80	23.07692	19.35484	Medium	18 to 26	3.225806
Very Bad	> 80	12.82051	12.90323	Bad	> 26	9.677419
GROUND WATER ISSUES						
1. Inland Salinity		Ground water salinity				
Limited availability of fresh GW		Limited availability of fresh water				
		Water logging				
		Ground water contamination				
3. Rainfall and Drought		Mild Droughts in 22% years				
		Normal Droughts in 18% years				
		Severe Drought in 12% years				
GROUND WATER RESOURCE & EXTRACTION						
Ground Water Recharge Worthy Area (Sq. Km.)		57.1				
Total Annual Ground Water Recharge (mcm)		9.849311				
Natural discharge during non monsson season (mcm)		0.984931				
Net Annual Ground Water Availability (mcm)		8.86438				
Existing Gross Ground Water Draft for All		5.456696				

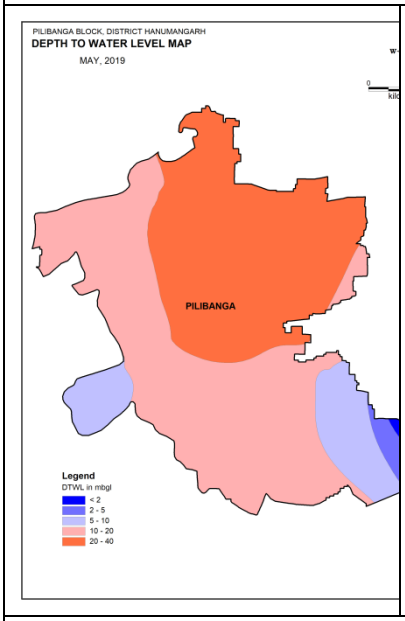
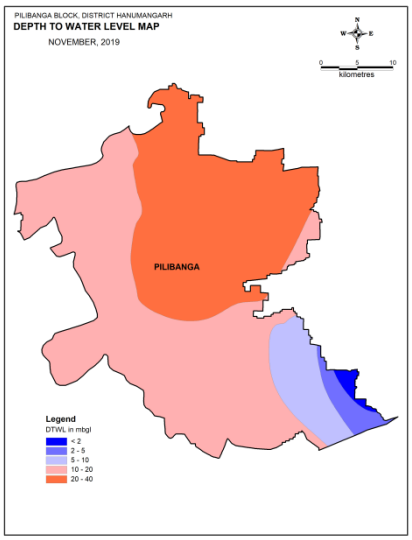
uses(mcm)	
Provision for domestic and industrial requirement supply to 2025(mcm)	0.189
Stage of Ground Water Development %	61.56
Category	SAFE
In-Storage Resource	
Total Area (Sq. km)	2432.9
Dynamic Resource (mcm)	8.8644
Utilizable Volume (mcm)	15.248
Total In-storage Resource (mcm)	130.5991
Total Resource Dynamic + In-storage	139.4635
Sustainability Period in years with existing draft	Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT	
Area identified for Artificial Recharge & Conservation	57.1
Existing Structures constructed by State Govt.	42
Anicut	0
Diggy/ jalhoj	14
Earthen Checkdam	0
Johad	18
Mini Percolation tank	5
Minor Irrigation Tank	0
Recharge Shaft	5
Sub Surface barrier	0
Talai (Talab)	0
Water Harvesting Structure	0
Traditional Ground water conservation structures (Tanka) capacity of 50000lit	4929.2
No DCB	215
Pri Annual Extractable	886.438

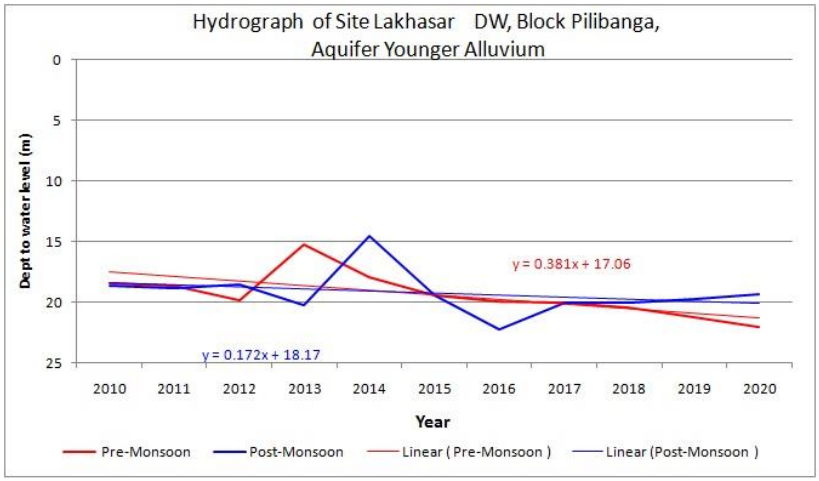
or to intervention	Ground Water (ham)	
	Current annual gross ground water extraction for 'All Uses' (ham)	545.6696
	Resource surplus (hem)	340.7684
	Category	Safe
Geographical Area of Block (sq km)		2439.45
Potential Area (sq km)		57.1
Saline area (sq km)		2382.35
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may betaken and used
% Availability of Fresh ground water area		2.340691549
%Availability of of Saline ground water area		97.65930845
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerance crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		543.48
% of Irrigated area		22.27879235
Increase in 10 % of total irrigated area(sq km)		597.828
% of Irrigated area		24.50667159
Expected Benefits		
Post intervention	**Stage of GW Development**	61.55755958
	Current annual gross ground water extraction for 'All Uses' (ham)	608.63
	Stage after intervention	68.6601883
	Category	Safe

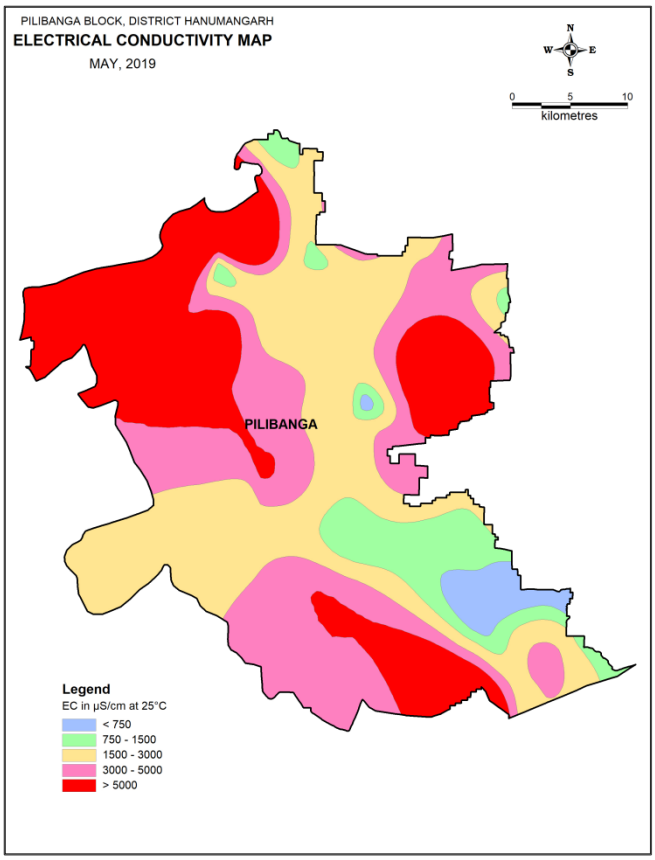
SALIENT INFORMATION	**PILIBANGA**	
Block Name	**PILIBANGA**	
Longitude	73°45'43.2" and 74°17'45.6" East	
Latitude	29°15'28.8" and 29°43'26.4" North	
Geographical Area sq.km	1195.8	
Population (2011)	217439	
Climate	Aird, Extreem hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	256	
Mean Annual rainfall (mm)	255.8888889	
Highest annual rainfall (mm) with year	394(2013)	
Lowest annual rainfall (mm) with year	67(2002)	
Standard deviation (mm)	95.81224832	
Coefficient of Variation (%)	37.44291076	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	4	22.22222222
Normal (-25% to -50%)	3	16.66666667
Severe (-50% to -75%)	2	11.11111111
Most severe (-75% to -100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-Along Ghaggar river	

	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts
	
Elevation (m amsl)	164.1 to 221.3
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age: Recent to Sub-recent
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age: Quaternary
	• Sand stone poorly cemented, with variegated clay Age: Tertiary

Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	99212
Forest Area in ha.	2760
Net Sown Area in ha.	78697
Area sown more than once in ha.	61511
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/

	Wheat
Area under Irrigation (Net) in ha	133318
Surface Water	127459
Ground Water	5859
Other sources	0
Contribution of Surface Water %	95.6052446
Contribution of Ground Water %	4.394755397
Principal Crops	
Crop Type Wheat	43442
Barley	1552
Gram	2994
Sarso	19674
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	4
SGWD	8
NAQUIM Key Wells	8
WATER LEVEL BEHAVIOUR	Pre Monsoon
	 
	(May-2019)
Water Level (m bgl)	9.53 - 30.07

Water Level Trend (2010-2019)		
Average Trend (m/year)	1.45	
	Pre Monsoon	
Rise	(-0.4) -(-0.14)	
Fall	0.17 - 3.61	
AQUIFER DISPOSITION		
Number of Aquifers (Major)	Two	
I	Alluvium	
II	Alluvium& Tertiary	
Status of GW Exploration	CGWB	GWD
	19	0
BASIC AQUIFER CHARACTERISTICS		
Type of Aquifer	Phreatic	Semi confined
Depth of Occurrence (mbgl)	50 - 100	110 -150
Yield Potential	165 - 1000	100 - 2000
Specific Yield (Sy)	0.015	
Transmissivity (T)		

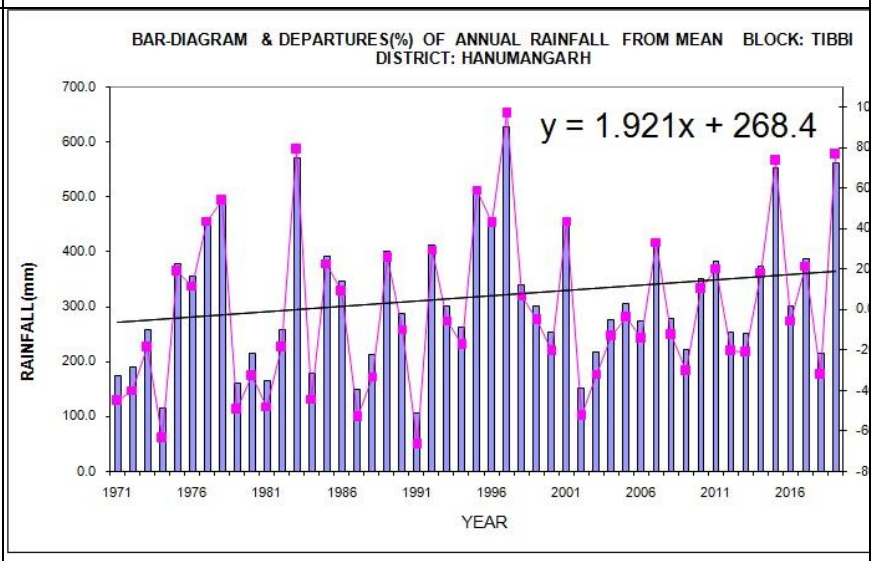
<table>
<tr><td colspan="2">CHEMICAL QUALITY OF GROUND WATER</td><td> 
</td></tr>
<tr><td colspan="2">Electrical ConductivityµS/cm at 25°C</td><td>960 - 15600</td></tr>
<tr><td colspan="2">pH</td><td>7.56-8.4</td></tr>
<tr><td colspan="2">Suitability for Drinking</td><td></td></tr>
<tr><td>TDS</td><td>Range</td><td>% Samples</td></tr>
<tr><td>Fresh</td><td>0-3000</td><td>50</td></tr>
<tr><td>Brackish</td><td>>-3000</td><td>50</td></tr>
<tr><td>Hardness</td><td>Range</td><td>% Samples</td></tr>
<tr><td>Soft</td><td>0 – 75</td><td>0</td></tr>
<tr><td>Moderately Hard</td><td>75 – 150</td><td>0</td></tr>
<tr><td>Hard</td><td>150 – 300</td><td>25</td></tr>
<tr><td>Very Hard</td><td>>300</td><td>75</td></tr>
<tr><td>NO3 in mg/l>45 mg/l</td><td>permissible limit</td><td>2</td></tr>
</table>

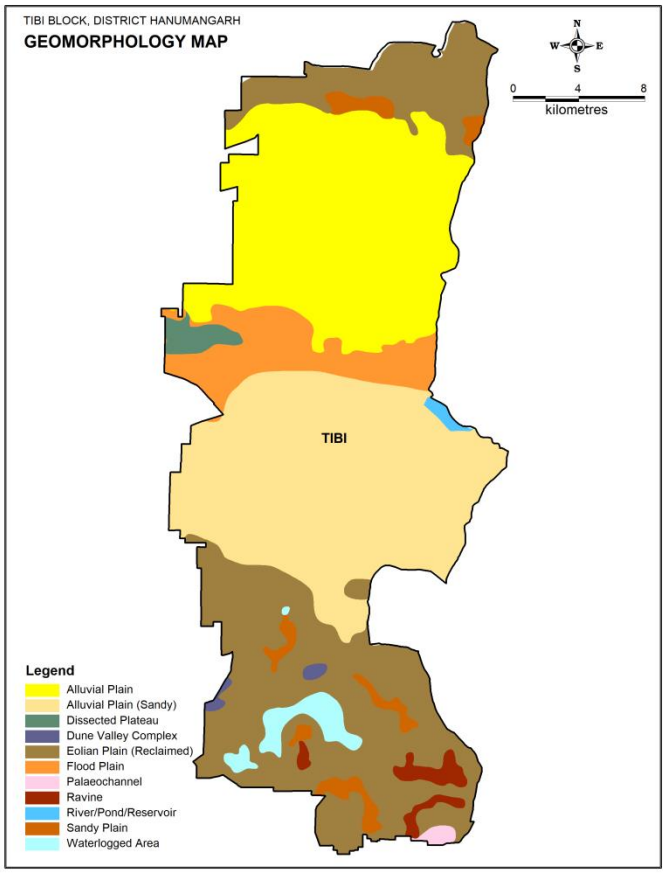
F in mg/l – 1 to 1.5 mg/l	Between DL & PL	1				
>1.5 mg/l	> Permissible limit	2				
Suitability for Irrigation						
EC						
Type of Water	**Classification**	% Samples	RSC(meq/L)	% Samples		
			< 1.25	75		
Low Saline< 250 mg/l	Excellent	0	1.25 -2.0	0		
Medium Saline 250–750 mg/l	Good	0	2.0 -2.5	0		
Highly Saline 750 –2250 mg/l	Permissible	50	2.5-3.0	0		
Very Highly saline>2250 mg/l	Doubtful	50	> 3.0	25		
Na%			SAR			
Water Class	**Range**	% Samples	% Samples	Water class	Range	% samples
Excellent	< 20	5.128205	0	Water class		
Good	20 - 40	35.89744	25	Excellenet	< 10	50
Medium	40 - 60	23.07692	25	Good	10 to 18	25
Bad	60 - 80	23.07692	25	Medium	18 to 26	25
Very Bad	> 80	12.82051	25	Bad	> 26	0

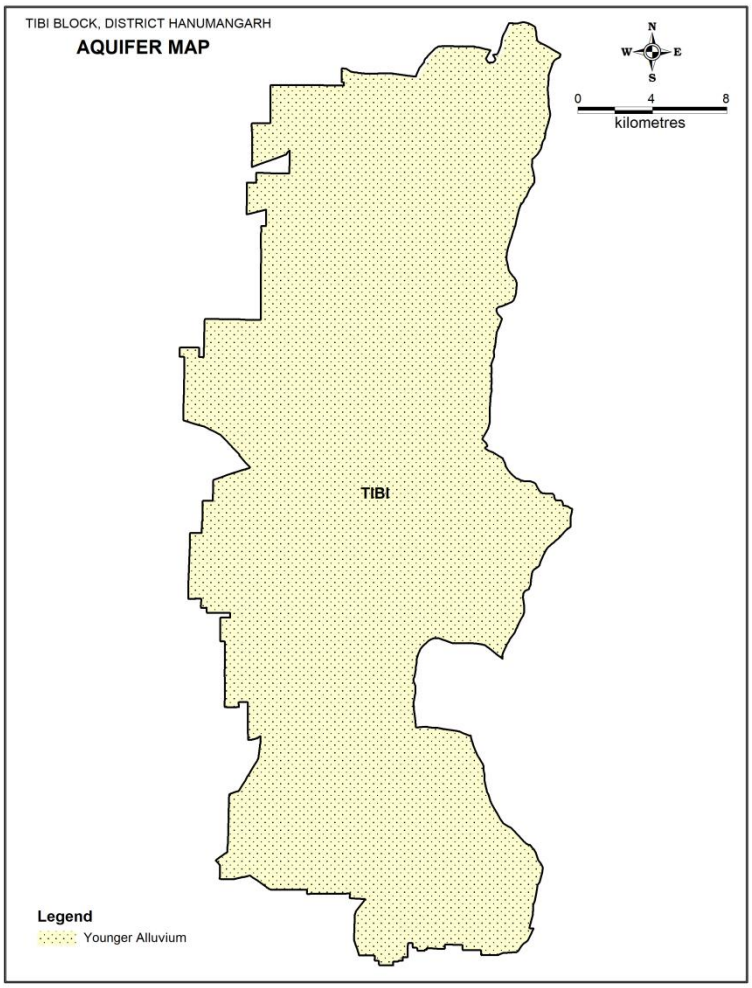
GROUND WATER ISSUES	
1. Inland Salinity	Ground water salinity
Limited availability of fresh GW	Limited availability of fresh water
	Water logging
	Ground water contamination
3. Rainfall and Drought	Mild Droughts in 22% years
	Normal Droughts in 17% years
	Severe Drought in 11% years
GROUND WATER RESOURCE & EXTRACTION	
Ground Water Recharge Worthy Area (Sq. Km.)	392.24
Total Annual Ground Water Recharge (mcm)	46.519085
Natural discharge during non monsson season (mcm)	4.651909
Net Annual Ground Water Availability (mcm)	41.867176
Existing Gross Ground Water Draft for All uses(mcm)	29.120858
Provision for domestic and industrial requirement supply to 2025(mcm)	2.6649
Stage of Ground Water Development %	69.56
Category	SAFE
In-Storage Resource	
Total Area (Sq. km)	1195.8
Dynamic Resource (mcm)	41.8672
Utilizable Volume (mcm)	8.264

Total In-storage Resource (mcm)		486.2207
Total Resource Dynamic + In-storage		528.0879
Sustainability Period in years with existing draft		Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT		
Area identified for Artificial Recharge & Conservation		392.24
Existing Structures constructed by State Govt.		16
Anicut		0
Diggy/ jalhoj		10
Earthen Checkdam		0
Johad		3
Mini Percolation tank		0
Minor Irrigation Tank		0
Recharge Shaft		1
Sub Surface barrier		0
Talai (Talab)		2
Water Harvesting Structure		0
Traditional Ground water conservation structures (Tanka) capacity of 50000lit		4119.8
No DCB		75
Prior to intervention	Annual Extractable Ground Water (ham)	4186.7176
	Current annual gross ground water extraction for 'All Uses' (ham)	2912.0858
	Resource surplus (hem)	1274.6318
	Category	Safe
Geographical Area of Block (sq km)		1128.02
Potential Area (sq km)		392.24
Saline area (sq km)		735.78
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may

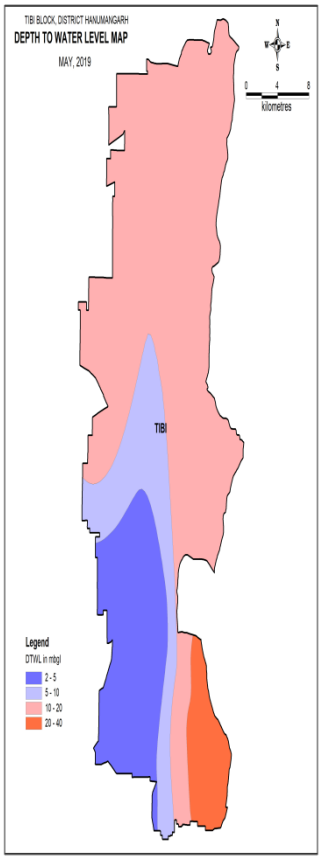
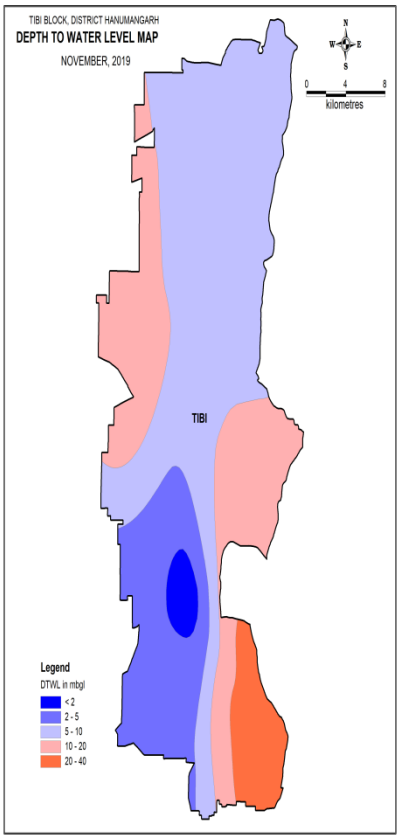
		be taken and used
% Availability of of Fresh ground water area		34.77243311
%Availability of of Saline ground water area		65.22756689
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerance crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		726.12
% of Irrigated area		64.37119909
Increase in 10 % of total irrigated area(sq km)		798.732
% of Irrigated area		70.808319
Expected Benefits		
Post intervention	**Stage of GW Development**	69.55534331
	Current annual gross ground water extraction for 'All Uses' (ham)	2800
	Stage after intervention	66.87816728
	Category	Safe

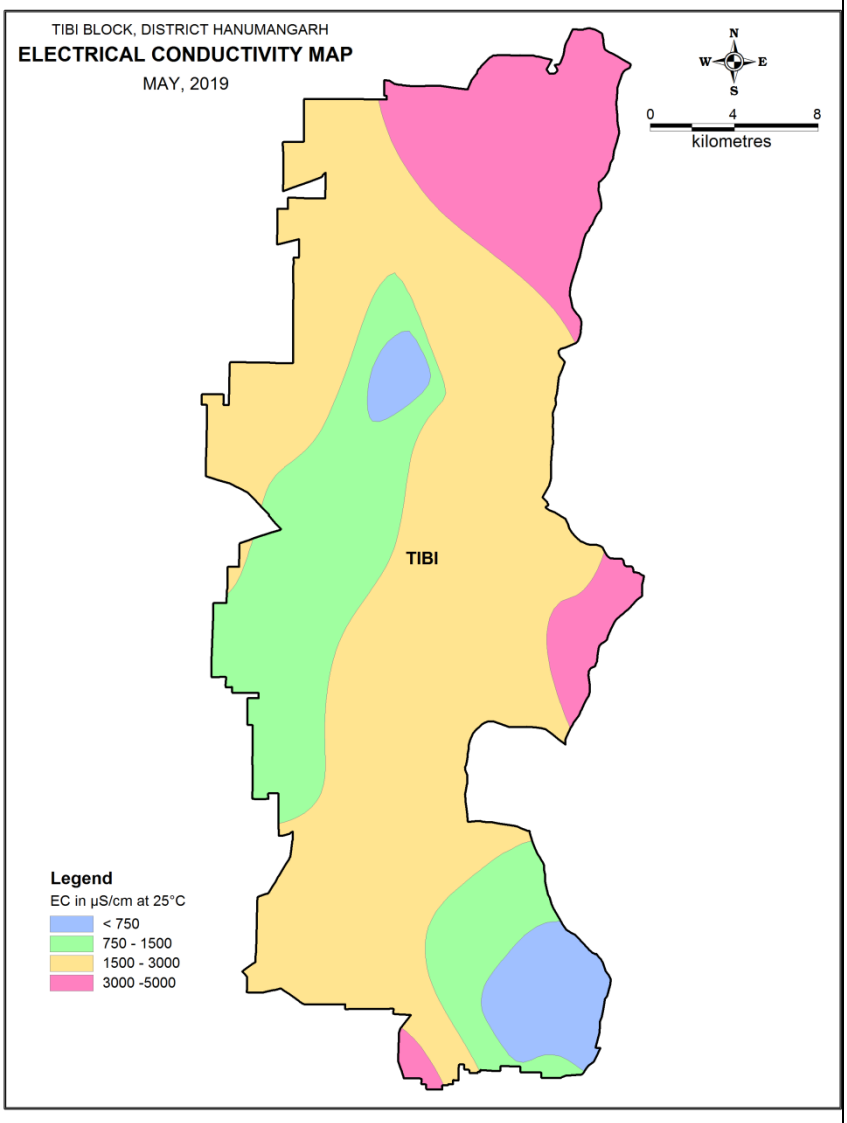
SALIENT INFORMATION	**TIBBI**	
Block Name	**TIBBI**	
Longitude	74°23'42" and 74°38'45.6" East	
Latitude	29°18'57.6" and 29°44'9.6" North	
Geographical Area sq.km	810.6	
Population (2011)	165217	
Climate	Aird, Extreem hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	326	
Mean Annual rainfall (mm)	318.6625	
Highest annual rainfall (mm) with year	626(1997)	
Lowest annual rainfall (mm) with year	105(1991)	
Standard deviation (mm)	123.7236286	
Coefficient of Variation (%)	38.82591411	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	14	28.57142857
Normal (-25% to -	10	20.40816327

50%)		
Severe (-50% to -75%)	4	8.163265306
Most severe (-75% to -100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-Along Ghaggar river	
	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	
		
Elevation (m amsl)	179.6 to 210.4	
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age:Recent to Sub-recent	
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age:Quaternary	
	• Sand stone poorly cemented, with variegated clay Age: Tertiary	

Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	Ghaggar
Minor Irrigation Projects CCA <2000ha	Canal
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	74429
Forest Area in ha.	214
Net Sown Area in ha.	65134
Area sown more than once in ha.	60021
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram

Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/ Wheat
Area under Irrigation (Net) in ha	119384
Surface Water	119384
Ground Water	0
Other sources	0
Contribution of Surface Water %	100
Contribution of Ground Water %	0
Principal Crops	
Crop Type Wheat	47004
Barley	687
Gram	3264
Sarso	9992
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	1
SGWD	3
NAQUIM Key Wells	8

		
WATER LEVEL BEHAVIOUR	Pre Monsoon	
	(May-2019	
Water Level (m bgl)	4.21 -32.1	
Water Level Trend (2010-2019)	Pre Monsoon	
Average Trend (m/year)	1.42	
	Pre Monsoon	
Rise	0-0	
Fall	0.002 - 5.24	
AQUIFER DISPOSITION		
Number of Aquifers (Major)		
I	Alluvium	
II	Alluvium& Tertiary	
Status of GW Exploration	CGWB	GWD
	3	0
BASIC AQUIFER CHARACTERISTICS		

Type of Aquifer		Phreatic	Semi confined
Depth of Occurrence (mbgl)		100-150	155- 250
Yield Potential		1200	440- 1800
Specific Yield (Sy)		0.015	
Transmissivity (T)			
CHEMICAL QUALITY OF GROUND WATER			
Electrical ConductivityµS/cm at 25°C		260 - 13500	
pH		1-8.93	
Suitability for Drinking			
TDS	**Range**	% Samples	

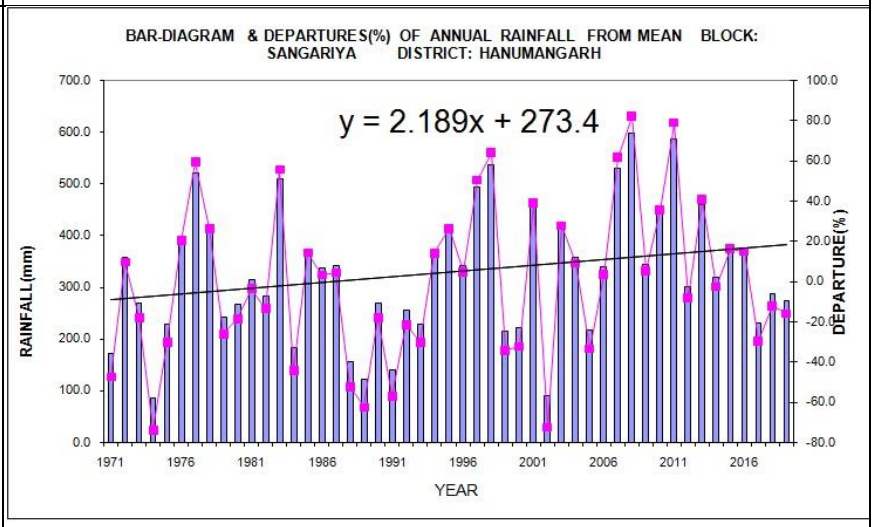
Fresh	0-3000		100			
Brackish	>-3000		0			
Hardness	**Range**		% Samples			
Soft	0 – 75		0			
Moderately Hard	75 – 150		12.5			
Hard	150 – 300		25			
Very Hard	>300		62.5			
NO3 in mg/l>45 mg/l	permissible limit		0			
F in mg/l – 1 to 1.5 mg/l	Between DL & PL		38			
>1.5 mg/l	> Permissible limit		0			
Suitability for Irrigation						
EC						
Type of Water	**Classification**		% Samples	RSC(meq/L)	% Samples	
				< 1.25	87.5	
Low Saline< 250 mg/l	Excellent		0	1.25 -2.0	0	
Medium Saline 250–750 mg/l	Good		25	2.0 -2.5	0	
Highly Saline 750 –2250 mg/l	Permissible		25	2.5-3.0	12.5	
Very Highly saline>2250 mg/l	Doubtful		50	> 3.0	0	
Na%				SAR		
Water	**Range**	% Samples	% Samples	Water class	Range	% samples

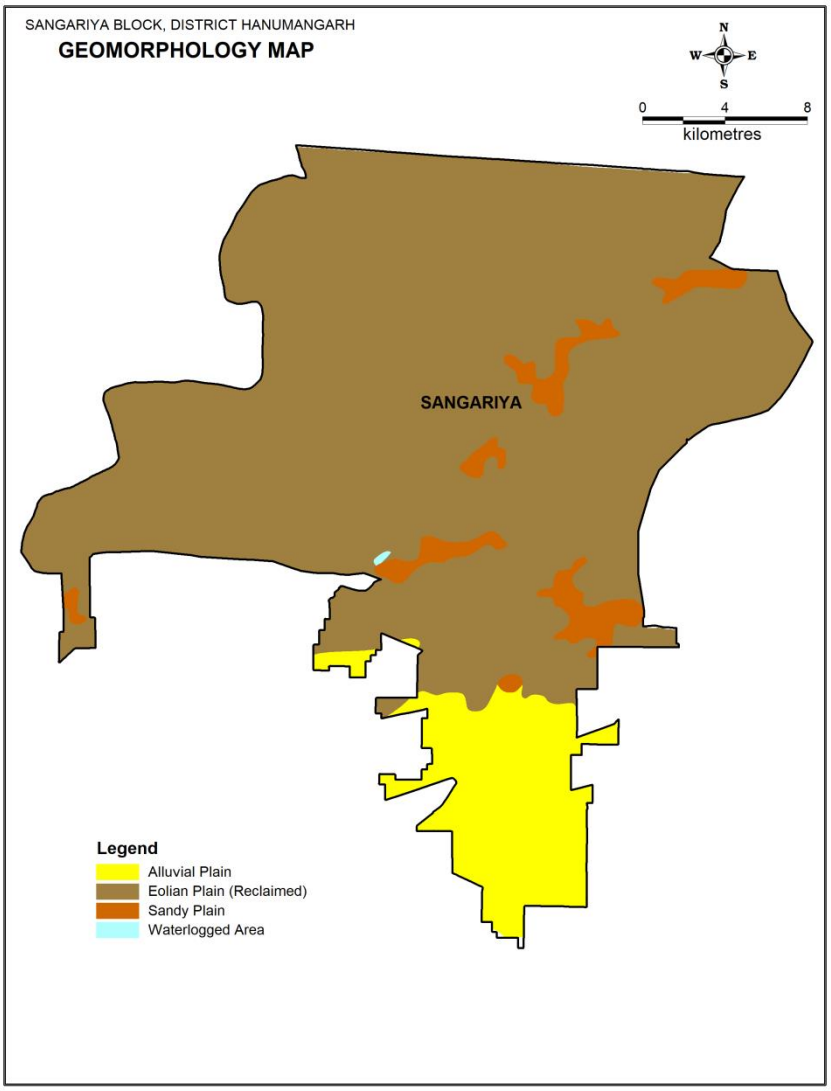
Class						
Excellent	< 20	5.128205	0	Water class		
Good	20 - 40	35.89744	37.5	Excellent	< 10	100
Medium	40 - 60	23.07692	37.5	Good	10 to 18	0
Bad	60 - 80	23.07692	25	Medium	18 to 26	0
Very Bad	> 80	12.82051	0	Bad	> 26	0
GROUND WATER ISSUES						
1. Inland Salinity			Ground water salinity			
Limited availablility of fresh GW			Limited availability of fresh water			
			Water logging			
			Ground water contamination			
3. Rainfall and Drought			Mild Droughts in 28% years			
			Normal Droughts in 20% years			
			Severe Drought in 8% years			
GROUND WATER RESOURCE & EXTRACTION						
Ground Water Recharge Worthy Area (Sq. Km.)			245.09			

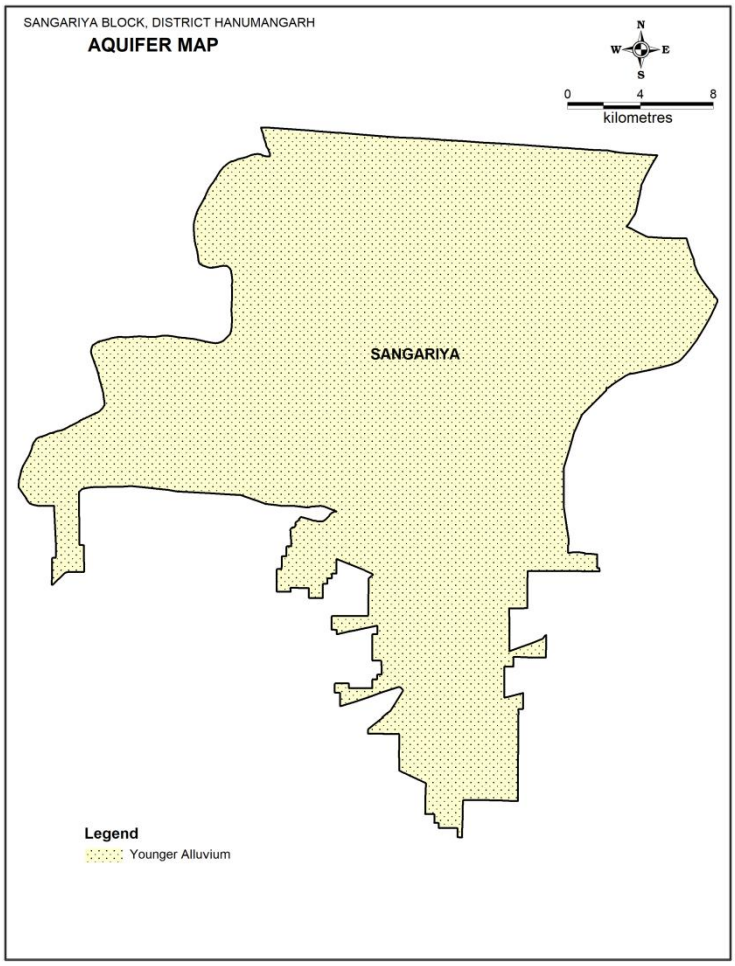
Total Annual Ground Water Recharge (mcm)	47.746407
Natural discharge during non monsson season (mcm)	4.774641
Net Annual Ground Water Availability (mcm)	42.971766
Existing Gross Ground Water Draft for All uses(mcm)	27.843858
Provision for domestic and industrial requirement supply to 2025(mcm)	1.89
Stage of Ground Water Development %	64.8
Category	SAFE
In-Storage Resource	
Total Area (Sq. km)	810.6
Dynamic Resource (mcm)	42.9718
Utilizable Volume (mcm)	15.076
Total In-storage Resource (mcm)	554.2465
Total Resource Dynamic + In-storage	597.2183
Sustainability Period in years with existing draft	Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT	
Area identified for Artificial Recharge & Conservation	245.09
Existing Structures constructed by State Govt.	6
Anicut	0
Diggy/ jalhoj	4
Earthen Checkdam	0
Johad	2
Mini Percolation tank	0

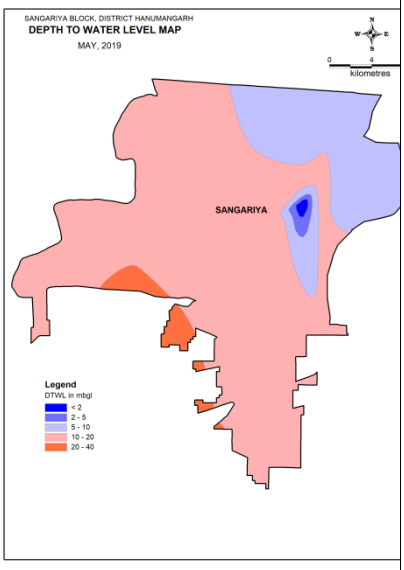
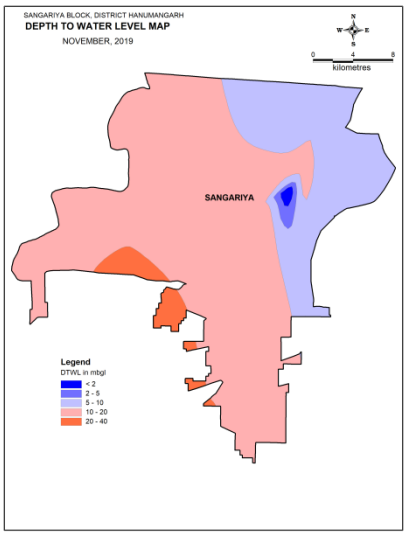
Minor Irrigation Tank		0
Recharge Shaft		0
Sub Surface barrier		0
Talai (Talab)		0
Water Harvesting Structure		0
Traditional Ground water conservation structures (Tanka) capacity of 50000lit		3140.1
No DCB		0
Prior to intervention	Annual Extractable Ground Water (ham)	4297.1766
	Current annual gross ground water extraction for 'All Uses' (ham)	2784.3858
	Resource surplus (hem)	1512.7908
	Category	Safe
Geographical Area of Block (sq km)		757.51
Potential Area (sq km)		245.09
Saline area (sq km)		512.42
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may betaken and used
% Availability of of Fresh ground water area		32.35468839
%Availability of of Saline ground water area		67.64531161
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerance crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		612.03
% of Irrigated area		80.794973
Increase in 10 % of total irrigated area(sq km)		673.233
% of Irrigated area		88.8744703
Expected Benefits		
Po	**Stage of GW Development**	64.7957033

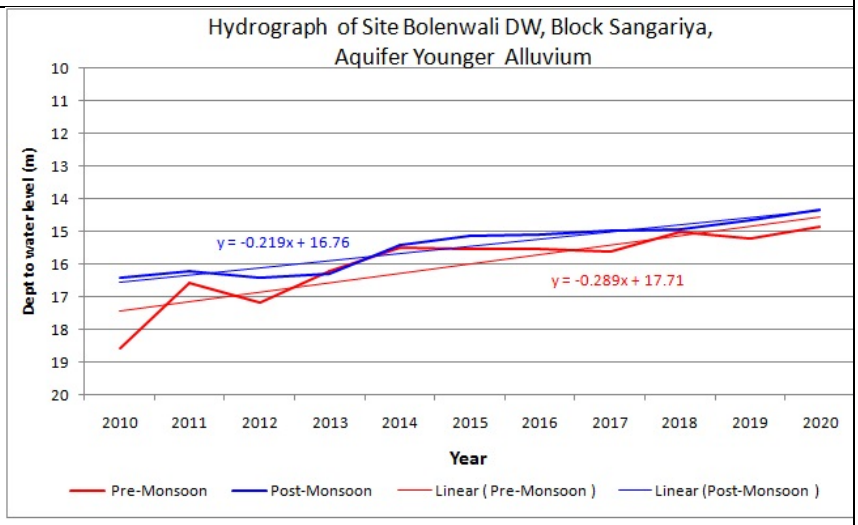
st int er ve nti on	**Current annual gross ground water extraction for 'All Uses' (ham)**	3033.14
	Stage after intervention	70.58448564
	Category	Semi Critical

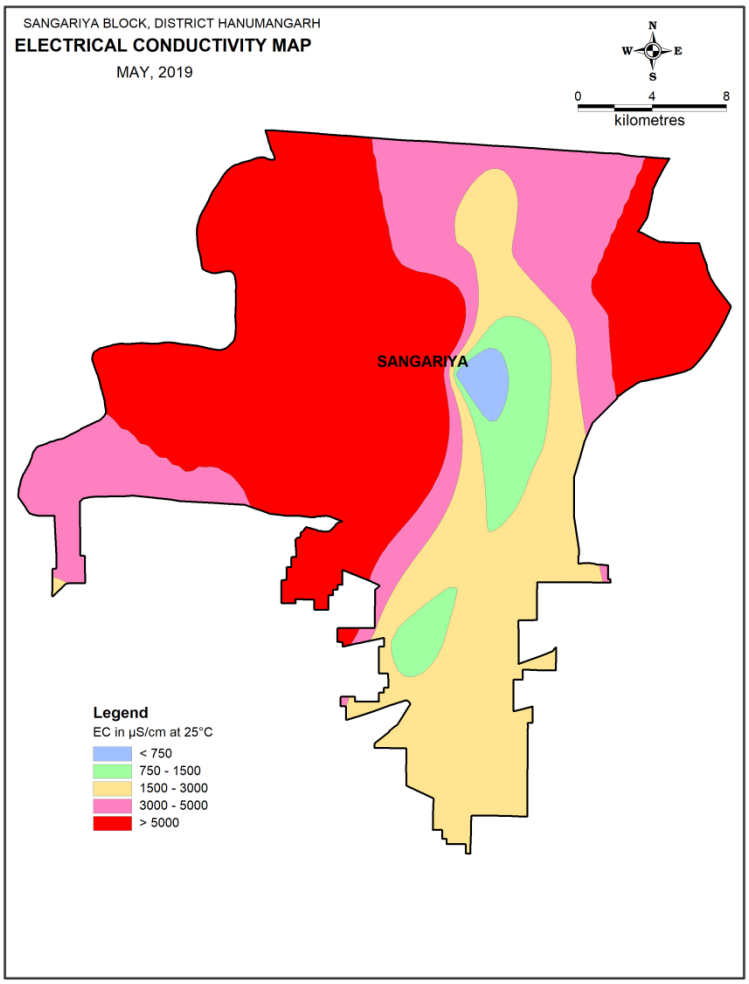
SALIENT INFORMATION	**SANGARIA**	
Block Name	**SANGARIA**	
Longitude	74°08'45.6" and 74°34'33.6" East	
Latitude	29°36'25.2" and 29°56'02.4" North	
Geographical Area sq.km	711.4	
Population (2011)	122524	
Climate	Aird, Extreem hot in summer & Cold in winter	
Average Temperature range (°C)	Maximum : 18 to 48	
	Minimum : 2 to 28	
Rainfall Analysis		
Normal Rainfall (mm)	342	
Mean Annual rainfall (mm)	328.1877551	
Highest annual rainfall (mm) with year	278(2008)	
Lowest annual rainfall (mm) with year	85(1974)	
Standard deviation (mm)	126.8369584	
Coefficient of Variation (%)	38.64768152	
Drought Analysis	No of Years of Drought	Frequency %
Mild (0 to -25%)	10	20.40816327
Normal (-25% to -50%)	9	18.36734694
Severe (-50% to -75%)	5	10.20408163
Most severe (-75% to -		0

100%)		
Geomorphology	a) 1 Fluvial plains-North of Ghaggar river, 2 Flood plain-Along Ghaggar river	
	b) 1 Aeolian Plain -Scattered in north and concentrated in southern part, 2 Dune complex- Scattered along eastern and western margins, 3 Interdunal depression-scattered in south eastern and south western parts	
		
Elevation (m amsl)	169.8 to 202.1	
Geology	• Wind Blown sand, alluvium, isolated calcareous and sediments with gypsum bed, Age: Recent to Sub-recent	
	• Alluvium, isolated calcareous and sediments with gypsum bed, Age: Quaternary	
	• Sand stone poorly cemented, with variegated clay Age: Tertiary	

Drainage & Hydrology	
Drainage **Basin/Sub-Basin**	
Minor Irrigation Projects CCA <2000ha	
LAND USE, AGRICULTURE, IRRIGATION & CROPPING PATTERN	
Geographical Area in ha.	65848
Forest Area in ha.	0
Net Sown Area in ha.	58785
Area sown more than once in ha.	50211
Rain-fed Crop	Pearl millet-Mustard, Fallow-Mustard/ Gram, Pearl millet-gram Black gram/ Cowpea / Cluster-bean - Mustard/ Gram
Irrigated Crop	Pearl millet-Mustard/ Wheat / Barley / Gram, Sesame - Mustard/

	Wheat
Area under Irrigation (Net) in ha	105972
Surface Water	105972
Ground Water	0
Other sources	0
Contribution of Surface Water %	100
Contribution of Ground Water %	0
Principal Crops	
Crop Type Wheat	34103
Barley	98
Gram	1075
Sarso	18616
Hydrogeology	
Monitoring Stations (May 2019)	
CGWB	4
SGWD	5
NAQUIM Key Wells	11
WATER LEVEL BEHAVIOUR	 
	Pre Monsoon
	(May-2019
Water Level (m bgl)	0.52 -19.23

Water Level Trend (2010-2019)	Pre & Post Monsoon	
		
Average Trend (m/year)	1.01	
	Pre Monsoon	
Rise	(-8.01) - (-0.37)	
Fall	0.38 -1.64	
AQUIFER DISPOSITION		
Number of Aquifers (Major)		
I	Alluvium	
II	Alluvium& Tertiary	
Status of GW Exploration	CGWB	GWD
	3	0
BASIC AQUIFER CHARACTERISTICS		
Type of Aquifer	Phreatic	Semi confined
Depth of Occurrence (mbgl)	35 - 62	110 - 200
Yield Potential	200	200 - 500
Specific Yield (Sy)	0.015	
Transmissivity (T)		

CHEMICAL QUALITY OF GROUND WATER		
Electrical ConductivityµS/cm at 25°C		310 - 13500
pH		7.34 - 8.47
Suitability for Drinking		
TDS	**Range**	% Samples
Fresh	0-3000	54.54
Brackish	>-3000	45.45
Hardness	**Range**	% Samples
Soft	0 – 75	0
Moderately Hard	75 – 150	9.09
Hard	150 – 300	18.18
Very Hard	>300	72.72

NO3 in mg/l>45 mg/l	permissible limit	36				
F in mg/l – 1 to 1.5 mg/l	Between DL & PL	55				
>1.5 mg/l	> Permissible limit	0				
Suitability for Irrigation						
EC						
Type of Water	**Classification**	% Samples	RSC(meq/L)	% Samples		
			< 1.25	81.81818182		
Low Saline< 250 mg/l	Excellent	0	1.25 -2.0	0		
Medium Saline 250–750 mg/l	Good	9.090909	2.0 -2.5	0		
Highly Saline 750 –2250 mg/l	Permissible	27.27273	2.5-3.0	0		
Very Highly saline>2250 mg/l	Doubtful	63.63636	> 3.0	18.18181818		
Na%			SAR			
Water Class	**Range**	% Samples	% Samples	Water class	Range	% samples
Excellent	< 20	5.128205	0	Water class		
Good	20 - 40	35.89744	27.27273	Excellenet	< 10	90.90909
Medi	40 - 60	23.07692	45.45455	Good	10 to 18	9.090909

um						
Bad	60 - 80	23.07692	27.27273	Medium	18 to 26	0
Very Bad	> 80	12.82051	0	Bad	> 26	0
GROUND WATER ISSUES						
1. Inland Salinity			Ground water salinity			
Limited availablility of fresh GW			Limited availability of fresh water Water logging Ground water contamination			
3. Rainfall and Drought			Mild Droughts in 20% years Normal Droughts in 18% years Severe Drought in 10% years			
GROUND WATER RESOURCE & EXTRACTION						
Ground Water Recharge Worthy Area (Sq. Km.)			180.76			
Total Annual Ground Water Recharge (mcm)			41.872594			
Natural discharge during non monsson season (mcm)			4.187259			
Net Annual Ground Water Availability (mcm)			37.685335			
Existing Gross Ground Water Draft for All uses(mcm)			22.99112			
Provision for domestic			0.9828			

and industrial requirement supply to 2025(mcm)	
Stage of Ground Water Development %	61.01
Category	SAFE
In-Storage Resource	
Total Area (Sq. km)	711.4
Dynamic Resource (mcm)	37.6853
Utilizable Volume (mcm)	15.076
Total In-storage Resource (mcm)	408.7707
Total Resource Dynamic + In-storage	446.456
Sustainability Period in years with existing draft	Sustainable for long period of time
GROUND WATER RESOURCE ENHANCEMENT	
Area identified for Artificial Recharge & Conservation	180.76
Existing Structures constructed by State Govt.	27
Anicut	0
Diggy/ jalhoj	10
Earthen Checkdam	0
Johad	2
Mini Percolation tank	0
Minor Irrigation Tank	0
Recharge Shaft	0
Sub Surface barrier	0
Talai (Talab)	15
Water Harvesting Structure	0
Traditional Ground water conservation structures (Tanka) capacity of 50000lit	2333.4
No DCB	211

Prior to intervention	Annual Extractable Ground Water (ham)	3768.5335
	Current annual gross ground water extraction for 'All Uses' (ham)	2299.112
	Resource surplus (hem)	1469.4215
	Category	Safe
Geographical Area of Block (sq km)		693.19
Potential Area (sq km)		180.76
Saline area (sq km)		512.43
Conjunctive Use		Blending of Ground water with surface water to the ratio of 1:3 may be taken and used
% Availability of Fresh ground water area		26.07654467
%Availability of Saline ground water area		73.92345533
Desilinitization		Deselinitization plant may use in saline area
Horticulture/Salt tolerence crop		Block has large part of saline area and horticulture and salt tolerance crop may be sown
Total irrigated area(Sq km)		563.66
% of Irrigated area		81.31392547
Increase in 10 % of total irrigated area(sq km)		620.026
% of Irrigated area		89.44531802
Expected Benifites		
Post intervention	**Stage of GW Development**	61.00813486
	Current annual gross ground water extraction for 'All Uses' (ham)	2500
	Stage after intervention	66.33880261
	Category	Safe

Annexure-I

Block wise rainfall data of Hunumangarh district

YEAR	Hanumangarh	Sangaria	Tibbi	Nohar	Bhadra	Pili Banga	Rawatsar	District
1971	121	172	173.3	314.8	314.8			58.11712
1972	214	359	190.2	437	437			146.8918
1973	296.2	268.5	258	480	480			164.5077
1974	75.5	85	115	263	263			37.89341
1975	274.5	229	377	679	679			205.5635
1976	495.6	394	354.5	510	510			240.4873
1977	253.3	522	456	520	520			237.2975
1978	314.4	414	489	588	588			246.6307
1979	102.3	242	160.3	250	250			73.56308
1980	134.9	267.1	213	338	338			106.0494
1981	264	315.8	165	430	430			143.3257
1982	329	283.4	257.5	322	322			147.408
1983	439	509.6	569	478	478			279.6317
1984	314	183	177	361	361			121.3851
1985	317	374.5	390	437	437			200.2921
1986	246.4	338.4	346	151	151			129.2442
1987	87	342	148	159	159			70.67092
1988	144	156	210	635	635			136.3617
1989	78	122.8	399	247	247			88.66355
1990	120	268.9	286	422	422			129.1344
1991	133	140.2	105	346	346			68.53027
1992	305	256.8	411	273	273			156.3161
1993	207	228.2	300	347	347			128.0548
1994	180.5	374	262	507	507			166.4495
1995	338	414	505	434	434			228.8445
1996	395	343	454	432	432			218.5209
1997	486	493	626	508	508			299.2982
1998	252	537	339	484	484			214.5325
1999	211	215	301	191	191			101.9034
2000	121	222	252	106	106			65.7051
2001	264	456	456	310	310			194.9356
2002	117	90	150	165	165	67	109	35.54553
2003	179	418	216	486	486	242	219	159.5606
2004	256	357	276	155	155	153	136	112.1288
2005	312	218	305	340	340	236	220	145.8046
2006	278	339	272	242	242	155	283	136.0128
2007	388	530	423	384	384	340	477	248.2029

2008	234	597	278	486	486	317	281	210.3205
2009	257	345	221	228	228	182	253	127.0169
2010	547	444	350	507	507	293	320	243.5245
2011	297	586	382	475	475	331	390	239.8716
2012	193	301	252	459	459	220	133	138.0407
2013	221	461	250	402	402	394	374	197.6408
2014	281	319	373	349	349	333	326	184.9222
2015	376	381	551	246	246	359	469	229.9978
2016	186	376	300	221	221	284	267	144.4766
2017	212	230	386	154	154	238	301	130.2629
2018	116	288	215	183	183	96	229	83.34158
2019	335	275	561	328	328	366	290	352.6

Annexure-II

Details of Exploratory tube wells

Sr. no	Location	Latitude	Longitude	Type of Well	Year of construction	Depth drilled(m)	Depth constructued(m)	Zones tapped(mbgl)From	Zones tapped(mbgl)to	Formation	SWL(m)	Discharge (lpm)	DD(m)	Transmisivity(m2/day)	Stora___s_	EC(mmhos/cm_at_25_C)	Cl(mg/l)	F(mg/l)	Block
1	Jhakranwali	29°21’	74°25’	EW	1961	91.44		-	-	Allu	-	-	-	-	-	49219	12000	-	HANUMANGARH
2	Hanumangarh	29°35’	74°19’	EW	76-78	120	190	27 31 39 51 61 73 83 94 100	29 34 41 57 68 79 89 97 108	Allu	10.32	174	7.23	1557	0.0025	880	54	0.24	HANUMANGARH
3	Pilibanga	29°29’	74°04’	EW	76-78	250.67	56	28 37 50	33 45 55	Allu	21.28	121	7.36	1580	0.015	3040	639	0.24	PILIBANGA

4	Chistian-I	29°40’	74°14’	E W	76-78	200	68	35 41 57 63	40 55 61 67	Allu	31.82	774	4.33	604	0.0065	1498	119	1.3	HANUMANGARH
5	Chistian-II	29°40’	74°14’	E W	76-78		150	99 104 109 120 127 136 145	102 107 112 123 130 140 148	Allu	31.93	345	13.5	80	0.013	4006	-		HANUMANGARH
6	Baropal	29°22’	74°05’	E W	76-78	155	98	13 24 31 41 54 64 72 84 92	16 28 36 49 60 68 78 90 96	Allu	6.13	2000	4.86	1392	0.0028	26131	9504	0.68	PILIBANGA

7	Suresala	29°36’	74°33’	E W	76-78	256.4	170	32 50 68 138 152	37 59 85 148 168	Allu	3.33	1800	14.6	1116	-	1287	73	1.17	TIBI
8	Dabli	29°32'45"	74°11'45"	E W	2003-04	199	37	26	31	Alluvium	18.5	125	4.25	-	-	2790	518	0.86	PILIBANGA
9	Roorawali	29°39' 40"	74°18'20"	E W	2003-04	199.4	152	43 55	49 64	Alluvium	I8.4	1000	1.6	-	-	1640	241	1.09	HANUMANGARH
10	6-8 LLW	29°42' 10"	74°21'00"	E W	2003-04	193.4	92	32 47 59 71 82	42 51 65 75	Alluvium	16	600	3.5	-	-	6470	781	14.3	HANUMANGARH
11	Satipura	29°37'30"	74°19'30"	E W	2003-04	199	134	45 60 73 102 122	51 66 79 108 131	Alluvium	13.41	650	6.67	-	-	1100	128	0.65	HANUMANGARH
12	Sawan Colony, H'mangarh	29°36'50"	74°18'30"	E W	2004-05	199.4	100	54 66 76	60 72 82	Alluvium	18.08	800	2.81	-	-	840	21	0.36	HANUMANGARH

13	Housing Board, H'mangarh	29°36 40"	74°16'20"	E W	2004-05	192.6	80	45 60	55 68	Alluvium	20.22	700	2.66	-	-	1590	270	0.85	HANUMANGARH
14	Dholipal	29°45'00"	74°16'00"	E W	2004-05	177.8	47	27 39	30 43	Alluvium	19.62	300	3.48	-	-	510	28	0.95	HANUMANGARH
15	Hanumangarh Town	29°34'50"	74°20'10"	E W	2004-05	189.3	123	90	120	Palana Sandstone	16.98	1100	2.12	-	-	1240	114	0.26	HANUMANGARH
16	Talwara	29°30'51"	74°37'15"	E W	2004-05	178.85	120	60 69 81 100	66 75 93 106	Alluvium	11.92	1000	-	-	-	1205	390	1.32	TIBI
17	Tibbi	29°34'40"	74°30'00"	E W	2005-06	192.4	135	78 98 123 129	83 108 127 132	Alluvium	14.5	1100	-	-	-	1190	50	0.59	TIBI
18	Panniwali	29°36'00"	74°26'00"	E W	2005-06	199.4	88	45 63 82	57 72 85	Alluvium	13.07	440	-	-	-	2510	362	0.71	TIBI
19	Amarpura Rathan	29°24'00"	73°59'00"	E W	2005-06	180	62	29 45 53	35 50 59	Alluvium	12.8	400	-	-	-	720	36	1.18	PILIBANGA
20	2 PBN	29°32'40"	74°08'10"	E W	2005-06	180.7	59	34 53	45 56	Alluvium	25.43	250	3.84	-	-	760	21	1.85	PILIBANGA
21	23 STG	29°29’ 40"	74°07'10"	E W	2005-06	199.1	37	28	34	Alluvium	22.42	100	1.98	-	-	880	75	0.4	PILIBANGA

22	Naiwala	29°36'40"	74°35'40"	E W	2005-06	187.1	175	74 88 126 141 150 157 172	82 92 134 145 154 160 175	Alluvium	13.2	850	5.57	-	-	2800	327	0.42	TIBI
23	Saharani	29°36'00"	74°34'00"	E W	2006-07	187.1	174.04	39 70.9 118 131 147 165	47 74.9 122 136 151 171	Alluvium	9.5	1100	4.08	-	-	2210	25	0.89	TIBI
24	Fatehpur	28°00'00"	76°19'00'	E W	2007-08	201.4	132	108 127	117 130	Palana Sandstone	19.05	600	-	-	-	1000	-	0.95	NAWALGARH
25	Tibbi	29°34'40"	74°30'00"	E W	2007-08	192.4	135	71 98 123 129	83 108 127 132	Alluvium	14.5	1100	-	-	-				TIBI
26	Panniwali	29°36'00"	74°26'00"	E W	2007-08	199.4	88	45 63 82	57 72 85	Alluvium	13.07	440	-	-	-				TIBI

27	Amarpura Rathan	29°24'00"	73°59'00"	E W	2007-08	180	60	29 45 53	35 50 59	Alluvium	12.8	400						PILIBANGA
28	23 STG	29°29’40"	74°07'10"	E W	2007-08	199.1	37	28	34	Alluvium	22.42	100	1.98	-	-	880	75	0.4	PILIBANGA
29	2 PBN	29°32'40"	74°08'10"	E W	2007-08	180.7	59	34 53	45 56	Alluvium	25.43	250	3.84	-	-	760	21	1.85	PILIBANGA
30	Pir Kamaria	29°36'8.64"	74°28'7.32"	E W	2008-09	200	152	69 78 126 144	75 84 134 149	Alluvium	13.6	1500	-	-	-	1520	-	0.42	TIBI
31	Khara Khera	29°41'56.4"	74°33'42.84"	E W	2008-09	186.3	56	41 50	50 56	Alluvium	5.35	420	-	-	-	990	-	0.19	TIBI
32	Rampura	29°21'51"	73°56'41"	E W	2009-10	200	39	30	36	Alluvium	7	300	-	-	-	700	-	0.28	SURATGARH
33	Daulatpura	29°39'00"	74°27'51"	E W	2009-10	200	144	99 119 132	105 125 141	Alluvium	16.4	600	-	-	-	1035	-	1.42	TIBI
34	Shergarh	29°40'42"	74°24'47"	E W	2009-10	200	141	91 116 130	94 124 139	Alluvium	18.3	550	-	-	-	1640	-	1.61	SANGARIYA
35	Longwala	29°30'58"	74°06'06"	E W	2009-10	200	113	44 104	62 110	Alluvium	20	600	-	-	-	1300	-	0.81	PILIBANGA
36	Satipura	29°37’	74°19’	SH	76-78			-	-	Allu	-	-	-	-	-	-	-	-	HANUMANGARH
37	Kohla	29°30’	74°19’	SH	76-78			-	-	Allu	-	-	-	-	-	-	-	-	HANUMANGARH

38	Chaiya	29°15’	74°29’	SH	76-78			-	-	Allu	-	-	-	-	-	-	-	-	RAWATSAR
39	Baropal	29°16’29 .28”N	74°04’44.76” E	PZ	76-78	135	16	10	12	-	-	-	-	-	-	-	-	-	PILIBANGA
40	Nagrana	29°42’	74°26’	PZ	76-78	189	94.3	38 59 80 89	46 63 84 92	Allu	24. 46	-	-	-	-	12192	2541	-	SANGARIYA
41	Bhukarka	29°14’	74°45’	PZ	76-78	188. 92	40.04	35	38	Allu	30. 98	-	-	-	-	11904	1775	1.8	NOHAR
42	Naurangdesar	29°24’	74°22’	PZ	76-78	120	39	28	34	Allu	17. 95	-	-	-	-	-	-	-	HANUMANGARH
43	Chak Sampatnagar (Deep)	29°41'50 "	74°17'40"	PZ	2003-04	198. 9	147	115 139	121 145	Alluvium	18. 49	660	13. 54	-	-	14870	3545	1.74	HANUMANGARH
44	Chak Sampatnagar (Shallow)	29°41'50 "	74°17'40"	PZ	2003-04	70.4	68	38 60	44 66	Alluvium	18. 5	700	3.9 5	-	-	15000	3545	1.37	HANUMANGARH
45	Tibbi	29°34'40 "	74°30'00"	PZ	2007-08	141. 2	124	98 113	101 122	Alluvium	10. 15	1200	-	-	-	1210	163	0.56	TIBI
46	R.A.U. Sub-station, Hanumangarh	29°33'00 "	74°18'00"	PZ	2007-08	186. 7	76	65	74	Alluvium	16. 24	900	-	-	-	14170	5325	0.56	HANUMANGARH
47	Kalibanga	29°28'12 .36"	74°07'58.08"	PZ	2008-09	201	60	53	59	Alluvium	21. 28	160	-	-	-	16820	-	0.48	HANUMANGARH
48	Bhagatpura	29°52'30 "	74°28'00"	PZ	2008-09	62	61	47	50	Alluvium	16. 3	200	-	-	-	17540	-	1.8	SANGARIYA
49	Rampura	29°21'51 "	73°56'41"	PZ	2009-10	199. 5	150	137	147	Alluvium	7	200	-	-	-	810	-	0.42	SURATGARH
50	Naiwala	29°36'40 "	74°35''40"”	PZ	2008-09	185. 8	164	150	162	Alluvium	13. 2	825	-	-	-	745	-	0.64	TIBI
51	Alai Ki	29°32'50 "	74°06'05"	E W	2010-11	151	120	115 134	130 140	Alluvium	24. 1	1000				1070	142	1.4	PILIBANGA
52	Goluwala	29°38'00 "	74°30'36"	E W	2010-11	200	55	40	49	Alluvium	21. 85	400				1180	142	10	TIBI

53	Pale wale Ki Dhani	20°40'00"	74°49'00"	PZ	2010-11	182	56	41	50	Alluvium	26	250				8450	1668	5	RAWATSAR
54	Pandita Wali	29°24'45"	74°12'00"	PZ	2010-11	130	44	36	42	Alluvium	8.98	165				28990	7668	1.15	PILIBANGA
55	Chohila Wali	29°42'45"	74°17'00"	PZ	2010-11	152	45	37	43	Alluvium	9.3	330				34000	10295	1.29	HANUMANGARH
56	Rawatsar Deep	29°57'00"	74°15'00"	PZ	2011-12	154	127	114	126	Alluvium	7.5	600				40500	12567	1.18	SADULSHAHAR
57	Rawatsar shallow	29°57'00"	74°15'00"	PZ	2011-12	0	190	12	18	Alluvium	7.6	30				10450	2166	0.468	SADULSHAHAR
58	Deidas	29°15’51.48”N	74°40’4.08”E	EW	2012-19	150	150												NOHAR
59	Ninan EW	29.17361	75.27528	EW	2019-20	150	150	########	########	Alluvium	16	700				29850			Bhadra
60	Ninan OW	29.17361	75.27528	OW	2019-20	150	150	########	########	Alluvium	16.43	480				39500			Bhadra
61	Deidas EW	29.26306	74.68583	EW	2019-20	150	150	########	########	Alluvium	16.16	480				39840			Nohar
62	Deidas OW	29.26306	74.68583	OW	2019-20	150	150	########	########	Alluvium	21.1	400				26400			Nohar
63	Dungrana EW	29.00694	75.09139	EW	2019-20	112	102	66,84,96	72,90,102	Alluvium	12.13	300				90120			Bhadra
64	Shyorani EW	29.0075	75.08444	EW	2019-20	97.3	53	36,45	42,51	Alluvium	20.75	100				4310			Nohar
65	Dabri EW	29.04694	75.40083	EW	2019-20	150	150	41,49	47,55	Alluvium	19.6	420							Bhadra
66	Ramgarh EW	29.18861	74.9675	EW	2019-20	127.1	75	37,47,66	43,53,72	Alluvium	22.18	350							Nohar

67	Uttaradabas EW	29.07833	75.21778	EW	2019-20	93.8	93	44,60,85	50,66,91	Alluvium	7.5	500							Bhadra
68	Bhaumpura EW	29.28389	74.46778	EW	2019-20	150	150	121,143	130,149	Alluvium									Hanumangarh
69	Jhandawali EW	75.27528	29.17361	EW	2020-21	215	214			Alluvium	30	1500				22200			Pilibanga
70	Jhandawali OW	75.27528	29.17361	OW	2020-21	215	214			Alluvium	32	480				30000			Pilibanga
71	Suranwali EW	73.93944	29.63278	EW	2020-21	225.7	221			Alluvium	26	1200				28000			Pilibanga
72	Suranwali OW	73.93944	29.63278	OW	2020-21	225.7	221			Alluvium	26	1000				26000			Pilibanga
73	BaghsarEW	73.94056	29.46889	EW	2020-21					Alluvium						24900			Pilibanga
74	Ratanpura EW	29.17361	75.27528	EW	2020-21					Alluvium						23000			Sangraia

Annexure-III

Ground water level data

Village	Lat	Long	Pre WL	Post WL	Flactuation	Block	District
Bhagatpura-Pz	29.8750	74.4670	12.80	12.94	-0.14	Sangariya	Hanumangarh
RATANPURA	29.8500	74.4500	0.52	0.30	0.22	Sangariya	Hanumangarh
BOLANWALI	29.8380	74.4100	15.20	14.95	0.25	Sangariya	Hanumangarh
DHOLIPAL	29.7580	74.2670	22.05	22.48	-0.43	Hanumangarh	Hanumangarh
SALEWALI	29.7000	74.4880	11.30	6.68	4.62	Tibi	Hanumangarh
Chak Sampatnagar2	29.6970	74.2940	23.63	24.07	-0.44	Hanumangarh	Hanumangarh
PAKKASARNA	29.6830	74.1630	27.46	28.04	-0.58	Hanumangarh	Hanumangarh
Pale Wali Dhani	29.6830	74.1000	24.65	25.00	-0.35	Hanumangarh	Hanumangarh
Goluwala	29.6330	74.0600	26.32	26.28	0.04	Pilibanga	Hanumangarh
GOLUWALA	29.6330	74.0600	25.80	25.84	-0.04	Pilibanga	Hanumangarh
SATIPURA	29.6250	74.3170	26.33	27.14	-0.81	Hanumangarh	Hanumangarh
Hanumangarh Rau	29.6170	74.2830	22.68	22.56	0.12	Hanumangarh	Hanumangarh
LAKHASAR1	29.5630	73.9710	21.20	19.70	1.50	Pilibanga	Hanumangarh
KOHLA	29.5610	74.3330	20.53	21.04	-0.51	Hanumangarh	Hanumangarh
Kalibanga-Pz	29.4750	74.1270	25.38	24.71	0.67	Pilibanga	Hanumangarh
Rampura	29.4180	73.9040	9.53	10.71	-1.18	Pilibanga	Hanumangarh
PANDITAWALI	29.4130	74.2000	8.89	8.50	0.39	Pilibanga	Hanumangarh
CHOHLINYAWALI	29.3790	74.2710	1.72	1.16	0.56	Hanumangarh	Hanumangarh
CHISTIAN	29.3590	74.5990	32.10	33.95	-1.85	TIBI	Hanumangarh
NOHAR1	29.2810	74.7670	14.83	15.02	-0.19	Nohar	Hanumangarh
Rawatsar Shallow	29.2550	74.4100	6.88	7.00	-0.12	Rawatsar	Hanumangarh
Rawatsar Deep	29.2550	74.4100	7.15	7.03	0.12	Rawatsar	Hanumangarh
RAWATSAR	29.2530	74.4140	2.03	2.40	-0.37	Rawatsar	Hanumangarh
RAMSARA1	29.2500	74.8330	18.24	18.45	-0.21	Nohar	Hanumangarh
BHUKARKA	29.2330	74.7500	14.03	15.77	-1.74	Nohar	Hanumangarh
GANDEHALI	29.2170	74.5330	4.22	4.17	0.05	Rawatsar	Hanumangarh
CHHANI BARI	29.1830	75.3250	14.23	13.92	0.31	Bhadra	Hanumangarh
DHANASAR	29.1830	74.3420	8.90	8.96	-0.06	Rawatsar	Hanumangarh
MUNSARI	29.1000	75.0330	14.42	14.34	0.08	Bhadra	Hanumangarh
BIRAMSAR	29.0750	74.3000	23.95	23.89	0.06	Rawatsar	Hanumangarh
LAKHASAR2	29.0330	74.7330	15.35	15.47	-0.12	Nohar	Hanumangarh
PURABSAR	29.0330	74.2830	31.30	33.92	-2.62	Rawatsar	Hanumangarh
DUNGRANA	29.0140	75.0970	11.47	11.75	-0.28	Bhadra	Hanumangarh
LAKHERAN	28.9750	74.2920	36.90	36.60	0.30	Rawatsar	Hanumangarh
MALSISAR	28.9710	75.0330	13.82	13.52	0.30	Bhadra	Hanumangarh

PALLU	28.9170	74.2000	42.70	43.60	-0.90	Rawatsar	Hanumangarh
DUDHAL	28.9080	74.1330	48.45	48.92	-0.47	Rawatsar	Hanumangarh
BISRASAR	28.8670	74.2780	44.45	43.88	0.57	Rawatsar	Hanumangarh
Anupsahar	28.95561	75.20823	12.09	12.14	-0.05	Bhadra	Hanumangarh
Bambal Bas	29.25158	75.28399	12.89	12.78	0.11	Bhadra	Hanumangarh
Bambal Bas	29.26562	75.28424	10.26	10.15	0.11	Bhadra	Hanumangarh
Bhangarh	28.92299	75.35262	14.87	15.15	-0.28	Bhadra	Hanumangarh
Chanibari	29.18036	75.31306	12.53	12.68	-0.15	Bhadra	Hanumangarh
Dabri	29.04661	75.4118	16.90	16.48	0.42	Bhadra	Hanumangarh
Dungarana	29.01273	75.10085	18.15	17.59	0.56	Bhadra	Hanumangarh
Dungarbas	29.15216	75.1799	15.18	15.06	0.12	Bhadra	Hanumangarh
Jhansal	29.19411	75.38659	3.22	1.61	1.61	Bhadra	Hanumangarh
Malsisar	28.97143	75.02184	14.31	13.63	0.68	Bhadra	Hanumangarh
Ninan	29.17268	75.27005	11.67	11.44	0.23	Bhadra	Hanumangarh
Sardarpurabas	29.22952	75.17813	8.64	8.47	0.17	Bhadra	Hanumangarh
Sherera	29.97757	75.49423	17.68	17.37	0.31	Bhadra	Hanumangarh
Dholipal	29.75343	74.27189	21.04	21.62	-0.58	Hanumangarh	Hanumangarh
Hiranwali	29.70491	74.24309	23.52	23.22	0.30	Hanumangarh	Hanumangarh
Jhambar	29.55288	74.41389	14.86	14.81	0.05	Hanumangarh	Hanumangarh
Jorkiyan	29.65978	74.28247	28.59	29.96	-1.37	Hanumangarh	Hanumangarh
Kishanpura S	29.89353	74.29143	8.51	8.88	-0.37	Hanumangarh	Hanumangarh
Kohla	29.55666	74.33133	18.72	19.59	-0.87	Hanumangarh	Hanumangarh
Mirjewali Mair	29.34666	74.49638	4.03	3.96	0.07	Hanumangarh	Hanumangarh
Munda	29.47587	74.40809	5.21	5.07	0.14	Hanumangarh	Hanumangarh
Nawan	29.64796	74.3445	27.85	29.49	-1.64	Hanumangarh	Hanumangarh
Pacca Sarnonka	29.68152	74.1626	27.42	31.46	-4.04	Hanumangarh	Hanumangarh
Padampura (Lilawali)	29.69185	74.15566	13.49	13.33	0.16	Hanumangarh	Hanumangarh
Ramsara	29.54441	74.28351	17.25	17.14	0.11	Hanumangarh	Hanumangarh
Satipura	29.62509	74.31944	27.13	28.14	-1.01	Hanumangarh	Hanumangarh
Bachusar	28.993	74.64136	30.87	30.43	0.44	Nohar	Hanumangarh
Bhagwansar	29.07099	74.62215	21.52	21.39	0.13	Nohar	Hanumangarh
Birkali	29.13987	74.5967	21.96	21.22	0.74	Nohar	Hanumangarh
Dalpatpura	29.07373	74.78208	14.92	12.15	2.77	Nohar	Hanumangarh
Durjana	29.02344	74.81441	16.84	15.92	0.92	Nohar	Hanumangarh
Gogamedi	29.17017	75.03081	21.61	18.24	3.37	Nohar	Hanumangarh
Hardaswali	29.1526	74.27101	14.92	15.32	-0.40	Nohar	Hanumangarh
Khopra	28.95458	74.8465	11.12	9.24	1.88	Nohar	Hanumangarh
Mundsari	29.15265	74.56349	22.06	21.68	0.38	Nohar	Hanumangarh
Parlika	29.2232	74.89998	16.45	15.78	0.67	Nohar	Hanumangarh
Phephana	29.3422	74.89818	10.24	10.42	-0.18	Nohar	Hanumangarh
Pohrka	29.1513	74.37589	13.98	13.87	0.11	Nohar	Hanumangarh
Ramsara	29.2524	74.82453	18.61	18.43	0.18	Nohar	Hanumangarh

Sonedi	29.17573	74.7008	21.92	21.52	0.40	Nohar	Hanumangarh
Ahamadpura	29.47037	74.03335	26.21	26.99	-0.78	Pilibanga	Hanumangarh
Alaiki	29.60449	74.10074	32.53	33.98	-1.45	Pilibanga	Hanumangarh
Dulmana	29.50812	74.10645	30.07	30.01	0.06	Pilibanga	Hanumangarh
Likhmisar	29.50398	74.0026	23.16	24.63	-1.47	Pilibanga	Hanumangarh
Suranwali	29.63325	73.94684	19.43	19.22	0.21	Pilibanga	Hanumangarh
Bisrasar	28.86533	74.26488	44.86	43.61	1.25	Rawatsar	Hanumangarh
Lakhera	28.97465	74.28669	37.29	36.63	0.66	Rawatsar	Hanumangarh
Pallu	28.93207	74.20775	42.14	42.16	-0.02	Rawatsar	Hanumangarh
Rawatsar	29.26543	74.40327	1.35	1.31	0.04	Rawatsar	Hanumangarh
Bolanwali	29.83322	74.41616	15.24	15.10	0.14	Sangaria	Hanumangarh
Haripura	29.92366	74.47923	6.23	6.71	-0.48	Sangaria	Hanumangarh
Kishanpura N	29.88998	74.29162	19.23	18.62	0.61	Sangaria	Hanumangarh
Manaksar	29.66328	74.39009	16.35	16.61	-0.26	Sangaria	Hanumangarh
Nagrana	29.6955	74.43043	15.62	15.51	0.11	Sangaria	Hanumangarh
Masitawali	29.43718	74.50568	2.17	1.57	0.60	Tibbi	Hanumangarh
Naurangdesar	29.39886	74.36999	4.21	4.91	-0.70	Tibbi	Hanumangarh
Tandurwali	29.61396	74.50121	10.12	9.34	0.78	Tibbi	Hanumangarh

Annexure-IV

Ground water quality data (Drining and domestic purpose)

Sr No	District	Block	Location	Aquifer	Lat.	Long	pH*	EC*in µS/cm at 25°C	CO_3	HCO_3	Cl*	SO_4	NO_3*	F*	PO_4	TH*	Ca*	Mg	Na*	K*	Agency
									mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	
1	HANUMANGARH	HANUMANGARH	RORANWALI	Younger Alluvium	29.6600	74.3047	7.34	7000	0	244	1503	1161	4.1	0.69	0.1	2440	336	388	493	18	Key wells
2	HANUMANGARH	Sangariya	INDRAPURA	Younger Alluvium	29.7936	74.26	7.98	5080	0	512	993	691	18.0	1.09	BDL	1480	248	209	485	19	Key wells
3	HANUMANGARH	Sangariya	INDRAGARH	Younger Alluvium	29.88	74.3178	7.96	7680	0	268	1290	1737	22.0	0.99	BDL	1960	288	301	868	20	Key wells
4	HANUMANGARH	Sangariya	LAMBI DHABI	Younger Alluvium	29.8458	74.3883	7.72	13500	0	366	2588	2744	19.0	0.82	BDL	5100	580	886	778	29	Key wells
5	HANUMANGARH	Sangariya	SANTPURA	Younger Alluvium	29.9058	74.4177	8.1	2800	0	220	539	488	7.1	1.03	BDL	750	100	121	321	10	Key wells
6	HANUMANGARH	Sangariya	DHABAN	Younger Alluvium	29.8744	74.51	8.11	5600	0	536	794	1142	81.0	1.08	BDL	1600	280	219	506	93	Key wells
7	HANUMANGARH	Sangariya	SANGARIYA	Younger Alluvium	29.7816	74.4619	7.99	1600	0	366	92	268	117.0	0.22	BDL	600	60	109	81	23	Key wells
8	HANUMANGARH	Sangariya	NAGRANA	Younger Alluvium	29.7194	74.4716	8.44	2400	12	415	184	532	70.0	1.08	BDL	390	40	70	383	9.31	Key wells
9	HANUMANGARH	Sangariya	LILANWALI	Younger Alluvium	29.7102	74.3769	8.47	1400	60	354	71	176	45.0	1.30	BDL	180	20	32	241	8.75	Key wells
10	HANUMANGARH	Sangariya	KIKARWALI	Younger Alluvium	29.7143	74.3358	8.07	7890	0	366	1177	1922	39.0	1.02	BDL	1620	176	287	1081	22	Key wells

11	HANUMANGARH	HANUMANGARH	KISHANPURA	Younger Alluvium	29.4511	74.308	7.82	6650	0	171	879	1840	81.0	1.26	0.1	2080	416	253	579	23	Key wells
12	HANUMANGARH	HANUMANGARH	MUNDA	Younger Alluvium	29.4611	74.4097	8.54	920	36	171	57	218	2.2	0.62	0.1	380	36	70	55	10	Key wells
13	HANUMANGARH	HANUMANGARH	LAKUWALI	Younger Alluvium	29.3422	74.3772	7.92	860	0	342	64	98	2.1	0.66	BDL	360	32	68	46	15	Key wells
14	HANUMANGARH	rawatsar	BHURANPURA	Younger Alluvium	29.3419	74.5622	7.99	520	0	122	35	118	6.1	0.87	BDL	200	48	19	35	5.56	Key wells
15	HANUMANGARH	Tibi	DABLI KHURD	Younger Alluvium	29.3986	74.4886	7.52	1800	0	329	146	410	13.0	1.14	BDL	470	84	63	198	12.62	Key wells
16	HANUMANGARH	Tibi	SILWALA	Younger Alluvium	29.485	74.5241	8.01	2600	0	342	198	698	18.0	1.13	BDL	580	68	100	328	11	Key wells
17	HANUMANGARH	Tibi	SUREWALA	Younger Alluvium	29.5991	74.5402	8.02	2370	0	390	234	528	13.0	0.30	BDL	850	108	141	161	9.26	Key wells
18	HANUMANGARH	Tibi	BASHIR	Younger Alluvium	29.6502	74.5036	8.25	1200	0	427	64	160	0.4	0.72	BDL	220	16	44	178	2.47	Key wells
19	HANUMANGARH	Tibi	PANNIWALI	Younger Alluvium	29.6144	74.4347	8.38	2700	48	329	142	786	15.0	0.56	BDL	740	104	117	290	11	Key wells
20	HANUMANGARH	HANUMANGARH	JANDAWALI	Younger Alluvium	29.6405	74.2286	8.41	5380	48	415	723	1224	16.0	0.48	BDL	1640	240	253	495	14	Key wells
21	HANUMANGARH	HANUMANGARH	HIRANWALI	Younger Alluvium	29.6913	74.2386	8.1	7200	0	903	822	1630	46.0	1.17	BDL	1140	160	180	1143	12	Key wells
22	HANUMANGARH	HANUMANGARH	UTTAMSINGHWALA	Younger Alluvium	29.7213	74.0964	8.48	2800	24	415	184	686	112.0	1.43	BDL	960	116	163	217	13	Key wells
23	HANUMANGARH	Pilibanga	UMEWALA	Younger Alluvium	29.7178	74.0214	8.05	1100	0	268	43	259	5.1	1.14	BDL	370	40	66	84	6.32	Key wells
24	HANUMANGARH	Pilibanga	AMARSINGWALA	Younger Alluvium	29.6455	74.9719	8.12	15600	0	366	4183	1562	20.0	0.95	BDL	3500	600	486	1976	39	Key wells

25	HANUMANGARH	Pilibanga	KHIOTHANWALI	Younger Alluvium	29.6202	74.8861	7.79	1490	0	464	64	288	8.3	1.11	BDL	620	100	90	67	13	Key wells
26	HANUMANGARH	Pilibanga	PAKKA BHADWA	Younger Alluvium	29.6619	74.1141	7.88	12290	0	366	2172	2672	30.0	0.79	BDL	2600	480	340	1628	30	Key wells
27	Hanumangarh	Hanumangarh	Malkoka	Younger Alluvium	29.6486	74.1514	7.98	2360	0	610	248	324	23	3.4	0.02	340	36	60	400	8.0	Key wells
28	Hanumangarh	Hanumangarh	Noorpura	Younger Alluvium	29.6078	74.1705	8.16	3700	0	390	780	500	20	0.6	0.01	1160	120	209	360	13.6	Key wells
29	Pilibanga	Hanumangarh	Ayalki	Younger Alluvium	29.6122	74.1067	8.28	1680	0	342	213	246	21	0.2	0.01	340	56	49	230	11.4	Key wells
30	Pilibanga	Hanumangarh	Hardyalpura	Younger Alluvium	29.6178	73.9766	7.97	910	0	195	42.5	230	3	4.0	0.01	390	84	44	35	6.0	Key wells
31	Pilibanga	Hanumangarh	Hansaliya	Younger Alluvium	29.5897	74.0247	8.93	2030	36.0	464	184	235	30	6.2	0.03	80	8	14.6	415	3.0	Key wells
32	Pilibanga	Hanumangarh	Thirajwala	Younger Alluvium	29.5214	74.9722	8.02	5510	0	293	1787	556	29	1.0	0.02	1060	136	175	1050	20	Key wells
33	Pilibanga	Hanumangarh	Sundarsinghwala	Younger Alluvium	29.5167	74.0167	8.06	3600	0	390	709	522	6.4	0.67	0.01	340	24	68	690	25.7	Key wells
34	Pilibanga	Hanumangarh	Pilibanga	Younger Alluvium	29.4961	74.0917	8.12	2000	0	537	326	103	90	0.40	0.02	680	152	73	170	25.6	Key wells
35	Pilibanga	Hanumangarh	Loungwala	Younger Alluvium	29.5478	74.0917	8.24	2600	0	415	354	450	40	0.62	0.03	530	32	109	370	8.2	Key wells
36	Hanumangarh	Hanumangarh	Makasar	Younger Alluvium	29.5964	74.2418	8.27	1080	0	512	56.7	33	17	7.0	0.01	180	44	17	176	4.0	Key wells
37	Hanumangarh	Hanumangarh	Dablirathan	Younger Alluvium	29.5378	74.1786	7.98	8190	0	317	1021	2427	4.0	1.75	0.01	2040	320	302	1000	17	Key wells
38	Pilibanga	Hanumangarh	Dulmana	Younger Alluvium	29.5139	74.1083	8.23	540	0	329	14.2	30	7.0	0.10	0.01	210	40	27	51	5.3	Key wells

39	Pilibanga	Hanumangarh	Dingwala	Younger Alluvium	29.46	74.0161	7.82	5180	0	403	1418	196	104	1.85	0.03	1380	256	180	555	29.8	Key wells
40	Pilibanga	Hanumangarh	Prempura	Younger Alluvium	29.4367	74.9539	8.18	1080	0	244	206	52	10	0.27	0.02	320	60	41	105	6.4	Key wells
41	Pilibanga	Hanumangarh	Saramsar	Younger Alluvium	29.4175	74.0139	8.60	1885	30.0	403	290	120	56	1.4	0.01	190	36	24	350	11.5	Key wells
42	Pilibanga	Hanumangarh	Badopal	Younger Alluvium	29.3569	74.0725	8.27	5200	0	1305	482	590	384	2.75	0.05	280	24	54	980	210	Key wells
43	Pilibanga	Hanumangarh	Daulatwali	Younger Alluvium	29.4011	74.1	8.37	1020	24.0	49	142	200	17	0.60	0.01	320	68	37	80	7.0	Key wells
44	Hanumangarh	Hanumangarh	Ramsaranarayan	Younger Alluvium	29.5417	74.2544	7.62	3080	0	305	460	432	260	0.55	0.06	770	32	168	355	15	Key wells
45	Hanumangarh	Hanumangarh	Bahlolnagar	Younger Alluvium	29.4789	74.1469	8.00	4440	0	378	737	725	60	0.60	0.02	760	136	102	630	21	Key wells
46	Pilibanga	Hanumangarh	Jakharnwali	Younger Alluvium	29.3436	74.2086	7.97	530	0	256	49.6	22	9.0	0.30	0.0	240	52	27	30	5.0	Key wells
47	Hanumangarh	Hanumangarh	Jorawarpura	Younger Alluvium	29.3436	74.3147	7.86	350	0	219	21	12	0.80	1.52	0.0	190	28	29	15	4.7	Key wells
48	Hanumangarh	Hanumangarh	Mainawali	Younger Alluvium	29.3658	74.3463	8.36	915	18.0	134	57	234	32	2.00	0.02	270	44	39	100	7.0	Key wells
49	Hanumangarh	Hanumangarh	Matoriyawali dhani	Younger Alluvium	29.4164	74.3653	7.62	3640	0	476	305	935	44	1.75	0.03	1210	384	61	280	13	Key wells
50	Hanumangarh	Hanumangarh	Araiyanwali	Younger Alluvium	29.4383	74.2752	7.78	6560	0	402	1191	1246	90	2.65	0.16	1320	320	126	940	21	Key wells
51	Tibi	Hanumangarh	Salemgarh	Younger Alluvium	29.5578	74.4639	8.15	790	0	329	50	50	12	0.21	0.01	290	20	58	50	6	Key wells
52	Hanumangarh	Hanumangarh	Nandram ki dhani	Younger Alluvium	29.5639	74.3922	8.30	2660	18.0	403	411	380	6	1.50	0.01	610	76	102	335	7	Key wells

53	Hanumangarh	Rawatsar	Ladam	Younger Alluvium	28.86056	74.16306	7.89	4560	0	488	1290	50	8.0	0.03	1.72	320	68	36.5	900	6.0	Key wells
54	Hanumangarh	Rawatsar	Ghaniyasar	Younger Alluvium	28.81861	74.13	7.61	276	0	98	35	15	5.0	BDL	0.25	130	32	12	8.0	4.1	Key wells
55	Hanumangarh	Rawatsar	Mehraon Ki Dhani	Younger Alluvium	28.97639	74.28028	7.53	260	0	98	28	9.0	5.0	BDL	0.25	110	24	12	9.0	4.7	Key wells
56	Hanumangarh	Rawatsar	Dewasar	Younger Alluvium	28.91833	74.39167	7.64	270	0	122	21	15	4.0	BDL	0.22	130	36	10	7.0	3.0	Key wells
57	Hanumangarh	Rawatsar	Khoda	Younger Alluvium	29.22889	74.28889	7.74	1790	0	647	227	77	130	BDL	0.57	750	64	148	105	32.7	Key wells
58	Hanumangarh	Rawatsar	Bhairtsari	Younger Alluvium	29.30389	74.27194	7.70	3780	0	634	539	612	45	0.03	1.95	920	184	112	470	14.0	Key wells
59	Hanumangarh	Rawatsar	Khedasari	Younger Alluvium	29.26583	74.26167	8.02	1160	0	342	170	18	45	0.03	2.00	310	52	44	120	7.7	Key wells
60	Hanumangarh	Rawatsar	Keshardeshar	Younger Alluvium	29.17667	74.33833	8.06	1980	0	464	354	20	75	0.05	3.25	410	60	63	250	14.3	Key wells
61	Hanumangarh	Rawatsar	Hardashwali	Younger Alluvium	29.15806	74.27917	1.54	7200	0			ACIDIC	Acidic Sample								Key wells
62	Hanumangarh	Rawatsar	Bangasar	Younger Alluvium	29.12444	74.18889	7.94	1960	0	744	121	100	130	0.12	1.37	410	48	71	240	48	Key wells
63	Hanumangarh	Rawatsar	Dhandhusar	Younger Alluvium	29.04694	74.15306	8.09	3020	0	695	326	36	626	0.47	4.00	650	76	112	415	24	Key wells
64	Hanumangarh	Rawatsar	Motar	Younger Alluvium	29.21833	74.16417	8.20	867	0	378	43	52	65	0.01	1.00	200	28	32	113	26.5	Key wells
65	Hanumangarh	Rawatsar	Daniyasar	Younger Alluvium	28.95361	74.16028	7.91	7980	0	451	1800	511	700	0.65	1.15	740	88	126	1500	8.6	Key wells
66	Hanumangarh	Rawatsar	Shirasar	Younger	28.96	74.10	8.20	277	0	134	21	26	3.0	BDL	0.26	150	40	12	8.0	3.7	Key

				Alluvium	806	778														wells
67	Hanumangarh	Rawatsar	Jhedasar	Younger Alluvium	29.02611	74.38778	7.82	1040	0	220	106	132	18	0.01	2.25	450	84	49	32	7.0	Key wells
68	Hanumangarh	Nohar	Kansar	Younger Alluvium	28.98472	74.41861	8.06	2820	0	366	241	326	575	0.04	3.10	770	92	131	305	17	Key wells
69	Hanumangarh	Rawatsar	Nyolakhi	Younger Alluvium	29.07583	74.44528	7.80	4200	0	183	454	1182	105	0.14	3.00	790	264	32	600	15.6	Key wells
70	Hanumangarh	Rawatsar	Rampura	Younger Alluvium	29.16278	74.43611	7.77	4380	0	268	1347	42	50	0.62	2.50	1290	260	156	415	14	Key wells
71	Hanumangarh	Rawatsar	4DWM	Younger Alluvium	29.21056	74.41778	7.94	546	0	268	21	46	12	0.02	0.62	250	28	44	21	10.5	Key wells
72	Hanumangarh	Rawatsar	Chaiya	Younger Alluvium	29.28	74.4775	8.00	5150	0	329	680	1208	110	0.40	3.00	1300	232	175	580	19	Key wells
73	Hanumangarh	Nohar	Thalarka	Younger Alluvium	29.2925	74.57083	7.66	1110	0	390	78	112	18	0.01	1.90	320	60	41	110	7.0	Key wells
74	Hanumangarh	Nohar	Dhandhela	Younger Alluvium	29.27944	74.62583	8.08	1490	0	537	177	15	65	0.01	3.40	600	104	83	46	52	Key wells
75	Hanumangarh	Nohar	Lalkhan ki Dhani	Younger Alluvium	29.31111	74.69944	8.13	240	0	122	14	1.5	2.64	BDL	0.25	110	32	7	6.0	2.0	Key wells
76	Hanumangarh	Nohar	Deidas	Younger Alluvium	29.29806	74.69528	7.55	253	0	122	21	0.5	2.56	BDL	0.22	120	24	14	6.0	2.0	Key wells
77	Hanumangarh	Rawatsar	Poharka	Younger Alluvium	29.15139	74.37611	8.24	1910	0	622	213	105.6	37	0.02	3.30	140	24	19	375	5.8	Key wells
78	Hanumangarh	Rawatsar	Hamirdeshar	Younger Alluvium	29.04528	74.44528	7.95	527	0	293	21	2.0	3.0	0.01	5.00	40	12	2.4	113	1.7	Key wells
79	Hanumangarh	Nohar	Thairana	Younger Alluvium	29.03028	74.50167	7.98	3130	0	573	609	38	225	0.05	5.00	470	64	75	440	108	Key wells
80	Hanumangarh	Nohar	Sirangsar	Younger	28.90	74.47	7.52	262	0	122	21	0.4	4.0	0.10	0.30	100	12	17	14	3.0	Key

				Alluvium	556	528														wells
81	Hanumangarh	Nohar	Khuia	Younger Alluvium	28.94306	74.56028	7.50	282	0	134	21	1.0	4.0	0.02	0.30	120	32	10	10	2.0	Key wells
82	Hanumangarh	Nohar	Dhansiya	Younger Alluvium	28.86639	74.52444	7.98	3113	0	427	312	195	775	0.35	3.30	650	88	105	355	160	Key wells
83	Hanumangarh	Nohar	Bhawalsar	Younger Alluvium	28.84278	74.60361	8.03	250	0	134	21	0.5	2.0	0.03	0.30	120	12	22	9.0	2.0	Key wells
84	Hanumangarh	Nohar	Jokhasar	Younger Alluvium	28.92333	74.64222	7.96	4600	0	293	1375	107	5.0	0.02	2.00	340	60	46	900	5.0	Key wells
85	Hanumangarh	Nohar	Sangthiya	Younger Alluvium	28.98694	74.70583	7.55	264	0	134	21	1.0	3.0	0.02	0.26	130	36	10	5.0	2.0	Key wells
86	Hanumangarh	Nohar	Ararki	Younger Alluvium	29.10167	74.7275	7.70	12530	0	866	3829	450	80	0.01	6.50	360	28	70	2875	42	Key wells
87	Hanumangarh	Nohar	Parlika	Younger Alluvium	29.22139	74.89889	7.73	450	0	73	28	121	3.0	BDL	0.61	200	36	27	11	4.7	Key wells
88	Hanumangarh	Nohar	Gudiya	Younger Alluvium	29.28833	74.89194	7.95	9130	0	268	1985	1460	55	0.02	2.75	2020	288	316	1175	16	Key wells
89	Hanumangarh	Nohar	Phephana	Younger Alluvium	29.33306	74.90028	7.96	1400	0	207	21	592	2.0	BDL	3.20	710	268	34	5.0	5.0	Key wells
90	Hanumangarh	Nohar	Charanwasi	Younger Alluvium	29.35194	74.85083	7.85	3140	0	305	468	673	55	BDL	5.20	647	96	70	520	10	Key wells
91	Hanumangarh	Nohar	Raytanpura	Younger Alluvium	29.35	74.80389	7.67	13250	0	244	3970	810	29	0.01	10.0	790	124	117	2700	26	Key wells
92	Hanumangarh	Rawatsar	Kanwani	Younger Alluvium	29.24083	74.51972	8.05	5764	0	342	1715	67.2	115	BDL	3.20	860	96	150	900	45	Key wells
93	Hanumangarh	NOHAR	ASARJANA	Younger Alluvium	29.17361	74.68722	7.47	390	0	110	43	38	4.45	0.014	0.205	170	24	27	10	3.48	Key wells
94	Hanumangarh	NOHAR	BIRKALI	Younger	29.14	74.61	7.	41830	0	61	88	760	95	0.0	1.8	76	12	111	61	50	Key

				Alluvium	167	361	5			0	62	8		09	66	00	00	7	38		wells
95	Hanumangarh	NOHAR	ANANUA	Younger Alluvium	29.09167	74.59806	8.48	1600	96	561	156	118	35	0.012	0.495	300	64	34	244	6.8	Key wells
96	Hanumangarh	NOHAR	GPRKHANA	Younger Alluvium	29.05528	74.65694	8.19	440	0	122	35	68	4.22	0.014	0.27	120	24	15	48	3.61	Key wells
97	Hanumangarh	NOHAR	MANDARPURA	Younger Alluvium	29.02	74.64	8.28	2400	0	512	227	364	131	0.004	0.58	320	40	53	414	5.49	Key wells
98	Hanumangarh	NOHAR	RANISAR	Younger Alluvium	28.95583	74.61222	8.42	500	36	110	35	36	6	0.007	3.146	40	8	5	97	0.55	Key wells
99	Hanumangarh	NOHAR	RATHUSAR	Younger Alluvium	28.94194	74.76333	8.1	1420	0	244	241	172	21	0.004	1.01	200	32	29	247	1.87	Key wells
100	Hanumangarh	NOHAR	MEGHANA	Younger Alluvium	28.98917	74.83611	7.66	7580	0	146	1659	1162	194	0.014	1.75	2400	520	267	526	227	Key wells
101	Hanumangarh	BHADRA	DOLAWALA BAS	Younger Alluvium	29.03583	74.80583	8.13	6860	0	439	1092	1462	37	0.011	1.14	780	104	126	1228	7.12	Key wells
102	Hanumangarh	BHADRA	BHADRA	Younger Alluvium	29.11778	75.1625	8.19	520	0	220	43	56	0.88	0.002	0.615	280	40	44	8.28	4.08	Key wells
103	Hanumangarh	BHADRA	BHOJASAR	Younger Alluvium	29.17111	75.17639	8.4	790	48	244	35	84	1.3	0.01	1.872	210	40	27	95	5.65	Key wells
104	Hanumangarh	BHADRA	SIRDARPURA BAS	Younger Alluvium	29.23306	74.17861	7.33	30000	0	244	8827	2336	10	0.015	2.246	5300	820	789	4456	87	Key wells
105	Hanumangarh	BHADRA	SAHUWALA	Younger Alluvium	29.22111	75.26028	8.01	600	0	85	78	112	3.01	0.011	0.18	250	36	39	21	3.43	Key wells
106	Hanumangarh	BHADRA	MAHRANA	Younger Alluvium	29.24389	75.37083	7.98	7190	0	293	850	2100	15	0.007	1.733	1080	240	117	1164	27	Key wells
107	Hanumangarh	BHADRA	BIRAN	Younger Alluvium	29.24389	75.37083	7.97	750	0	98	106	142	1.76	0.001	0.21	350	48	56	13	2.69	Key wells
10	Hanumangarh	BHADRA	JHANSAL	Younger	29.19	75.38	7.	1320	0	23	19	174	44	0.0	0.6	51	56	90	76	13	Key

8				Alluvium	417	861	78			2	9			15	2	0				wells
109	Hanumangarh	BHADRA	SAGRA	Younger Alluvium	29.08556	75.32056	8.42	2190	72	708	85	266	42	0.085	1.97	350	52	53	362	0.509	Key wells
110	Hanumangarh	BHADRA	DABRI	Younger Alluvium	26.04861	75.435	8.23	600	0	134	7	168	1.77	0.014	1.44	200	40	24	42	7.66	Key wells
111	Hanumangarh	BHADRA	AJEETPURA	Younger Alluvium	29.02333	75.30556	8.01	500	0	134	35	96	0	0.004	0.54	210	28	34	23	2.85	Key wells
112	Hanumangarh	BHADRA	JOGIWALA BAS	Younger Alluvium	29.03111	75.31806	8.07	370	0	49	28	98	2.22	0.045	1.06	150	20	24	16	3.27	Key wells
113	Hanumangarh	BHADRA	GOGAMEDI	Younger Alluvium	29.15667	75.03639	7.96	460	0	207	28	32	1.04	0.315	0.51	210	36	29	16	2.54	Key wells
114	Hanumangarh	BHADRA	RASALNA	Younger Alluvium	29.02333	75.05139	7.8	9320	0	1220	2070	688	78	0.042	4.76	980	128	160	1711	11.12	Key wells
115	Hanumangarh	BHADRA	GHEU	Younger Alluvium	29.02472	74.98111	8.14	690	0	110	170	52	1.5	0.007	0.715	310	48	46	36	3.05	Key wells
116	Hanumangarh	BHADRA	KANAU	Younger Alluvium	28.99611	74.91556	7.79	400	0	122	28	82	2.21	0.011	0.43	210	24	36	7.82	2.79	Key wells
117	Hanumangarh	BHADRA	KANJI	Younger Alluvium	28.96694	74.95028	7.85	390	0	110	34	67	4.08	0.075	0.5	190	28	29	8.82	3.34	Key wells
118	Hanumangarh	BHADRA	RAMASAR	Younger Alluvium	28.9525	75.7525	7.81	350	0	98	14	112	1.3	0.025	0.6	190	32	27	13	2.23	Key wells
119	Hanumangarh	BHADRA	MUNDARIABARA	Younger Alluvium	28.83889	75.07639	8.19	5000	0	744	794	596	208	0.014	0.635	960	120	160	716	5.62	Key wells
120	Hanumangarh	BHADRA	ALAILA	Younger Alluvium	28.89778	75.11833	7.92	470	0	98	35	126	1.91	0.019	0.525	220	36	32	19	2.93	Key wells
121	Hanumangarh	BHADRA	KIRAN BARA	Younger Alluvium	28.94472	75.13139	7.7	520	0	98	35	129	2.69	0.032	0.43	210	28	34	29	3.99	Key wells
12	Hanumangarh	BHADRA	KALANA	Younger	28.98	75.13	8.	2900	6	31	48	356	35	0.3	1.9	31	56	41	52	2.6	Key

2				Alluvium	833	778	31		0	7	9				4	0			5	6	wells
123	Hanumangarh	RAWATSAR	JHEDHASAR	Younger Alluvium	NM	NM	8.38	940	24	98	50	268	11	0.48	0.815	410	76	53	28	9.06	Key wells
124	Hanumangarh	NOHAR	SIRONGSAR	Younger Alluvium	NM	NM	8.07	5850	0	952	908	260	515	0.4	1.95	1160	200	160	596	233	Key wells
125	Hanumangarh	RAWATSAR	LALGASHIYA	Younger Alluvium	NM	NM	8.38	2600	72	378	305	408	19	0.015	0.905	180	20	32	515	3.43	Key wells
126	HANUMANGARH	NOHAR	BHUKARKA	Younger Alluvium	29.233	74.75	8.2	1400	0	217	279	179	12	1.55	0.05	390	80	46.29	170	10	NHS
127	HANUMANGARH	RAWATSAR	BIRAMSAR	Older Alluvium	29.075	74.3	7.72	280	0	108	53	63	9	0.27	0.07	145	36	13.42	40	6	NHS
128	HANUMANGARH	RAWATSAR	BISRASAR	Older Alluvium	28.867	74.278	8.42	1315	36	461	116	50	130	2.3	0.1	455	122	36.62	140	7	NHS
129	HANUMANGARH	SANGARIYA	BOLANWALI	Younger Alluvium	29.838	74.41	7.34	310	0	108	31	63	7	0.5	0.06	145	47	6.74	26	6.3	NHS
130	HANUMANGARH	TIBI	CHANDURWALA	Younger Alluvium	29.625	74.508	7.72	290	0	132	31	54	10	0.14	0.15	150	51	5.53	29	4	NHS
131	HANUMANGARH	TIBI	CHISTIAN	Younger Alluvium	29.359	74.599	8	530	0	193	74	47	5.6	1.38	0.1	205	55	16.48	50	9	NHS
132	HANUMANGARH	HANUMANGARH	CHOHLINYAWALI	Younger Alluvium	29.379	74.271	8.1	315	0	132	38	36	8	0.8	0.11	140	47	5.53	29	6	NHS
133	HANUMANGARH	RAWATSAR	DHANASAR	Older Alluvium	29.183	74.342	8.15	290	0	108	45	43	6	0.93	0.05	145	38	12.2	26	6	NHS
134	HANUMANGARH	HANUMANGARH	DHOLIPAL	Younger Alluvium	29.758	74.267	7.5	2040	0	413	351	205	55	0.17	0.1	795	171	89.56	115	42	NHS
135	HANUMANGARH	RAWATSAR	DUDHAL	Older Alluvium	28.908	74.133	8.1	830	0	230	81	130	55	0.28	0.05	105	39	1.87	172	6.3	NHS
13	HANUMAN	BHADRA	DUNGRAN	Younger	29.01	75.09	7.	350	0	14	31	66	7	0.7	0.0	16	51	7.96	35	1	NHS

6	GARH		A	Alluvium	4	7	2			4					9	0					
137	HANUMANGARH	RAWATSAR	GANDEHALI	Younger Alluvium	29.217	74.533	7.72	350	0	144	45	43	10	1.1	0.05	160	47	10.39	30	1.1	NHS
138	HANUMANGARH	PILIBANGA	GOLUWALA	Younger Alluvium	29.633	74.06	8.4	1400	36	498	81	105	67	5.4	0.12	170	43	15.25	260	19.7	NHS
139	HANUMANGARH	HANUMANGARH	Hanumangarh	Younger Alluvium	29.583	74.317	7.7	3350	0	230	612	550	75	2.5	0.2	750	200	61.03	420	24	NHS
140	HANUMANGARH	HANUMANGARH	KOHLA	Younger Alluvium	29.561	74.333	7.43	260	0	108	38	68	9	0.22	0.06	140	43	7.95	35	6	NHS
141	HANUMANGARH	PILIBANGA	LAKHASAR1	Younger Alluvium	29.563	73.971	7.56	7300	0	413	1757	1015	18	2.5	0.57	725	200	54.95	1450	19.4	NHS
142	HANUMANGARH	PILIBANGA	LAKHASAR1	Younger Alluvium	29.563	73.971	7.56	7300	0	413	1757	1020	18	2.5	0.57	725	200	54.95	1450	19.4	NHS
143	HANUMANGARH	NOHAR	LAKHASAR2	Younger Alluvium	29.033	74.733	8.2	380	0	193	31	42	5	1.1	0.4	140	35	12.81	49	3	NHS
144	HANUMANGARH	RAWATSAR	LAKHERAN	Older Alluvium	28.975	74.292	7.51	14420	0	315	3732	1185	70	0.15	0.7	1825	524	125.85	2290	15.5	NHS
145	HANUMANGARH	BHADRA	MALSISAR	Younger Alluvium	28.971	75.033	7.9	1965	0	310	450	165	41	0.52	0.05	540	124	56.07	250	10	NHS
146	HANUMANGARH	BHADRA	MUNSARI	Younger Alluvium	29.1	75.033	8	1460	0	230	329	90	16	1.3	0.19	260	59	27.42	227	9	NHS
147	HANUMANGARH	NOHAR	NOHAR1	Younger Alluvium	29.281	74.767	7.7	330	0	132	31	64	5	0.6	0.06	170	51	10.4	24	3	NHS
148	HANUMANGARH	HANUMANGARH	PAKKASARNA	Younger Alluvium	29.683	74.163	7.88	1100	0	339	202	56	10	0.31	0.06	125	47	1.88	230	5.5	NHS
149	HANUMANGARH	RAWATSAR	PALLU	Older Alluvium	28.917	74.2	7.53	300	0	108	38	81	8	0.1	0.21	155	43	11.6	35	4.6	NHS
15	HANUMAN	PILIBANGA	PANDITAW	Younger	29.41	74.2	8.	960	0	47	60	98	17	1.6	0.1	18	39	20.1	18	9	NHS

0	GARH		ALI	Alluvium	3		12			4					5	0		1	8		
151	HANUMANGARH	RAWATSAR	PURABSAR	Older Alluvium	29.033	74.283	7.65	4100	0	156	591	1005	158	0.55	0.37	1315	271	155.33	370	23	NHS
152	HANUMANGARH	NOHAR	RAMSARA1	Younger Alluvium	29.25	74.833	8	8300	0	810	1450	1405	40	0.34	0.56	2160	600	161.2	928	32	NHS
153	HANUMANGARH	SANGARIYA	RATANPURA	Younger Alluvium	29.85	74.45	8.45	1110	72	364	60	85	46	0.76	0.16	165	43	14.03	209	12.8	NHS
154	HANUMANGARH	RAWATSAR	RAWATSAR	Younger Alluvium	29.253	74.414	8.09	310	0	132	45	39	7	0.7	0.13	150	47	7.96	30	7	NHS
155	HANUMANGARH	TIBI	SALEWALI	Younger Alluvium	29.7	74.488	8	2780	0	474	492	335	44	0.31	0.2	475	100	54.83	456	12.5	NHS
156	HANUMANGARH	HANUMANGARH	SATIPURA	Younger Alluvium	29.625	74.317	7.52	1400	0	413	159	161	11	0.82	0.05	295	70	29.26	200	9.7	NHS

Annexure-V

Ground water Quality data (Irrigation & Industrial purpose)

Sr. No	Lat	Long	Block	Village	pH	EC Us at 25 ºC	Soluble sodium %	Sodium absorption ratio	Residual sodium carbonate	Sodium %	Permeability index	Magnecium %	Residual Sodium bicarbonate	Chloroalkaline Index 1	Chloroalkaline Index 2	Corrosavity ratio (CR)	Agency
1	29.6600	74.3047	HANUMANGARH	RORANWALI	7.34	7000	30.55	4.34	-44.73	31.00	0.44	65.52	-12.80	41.88	45.56	27.2890	Key wells
2	29.7936	74.26	Sangariya	INDRAPURA	7.98	5080	41.60	5.48	-21.21	42.16	0.71	58.11	-4.01	27.24	35.20	8.2826	Key wells
3	29.88	74.3178	Sangariya	INDRAGARH	7.96	7680	49.07	8.53	-34.78	49.41	0.96	63.24	-10.01	35.34	40.08	27.0809	Key wells
4	29.8458	74.3883	Sangariya	LAMBI DHABI	7.72	13500	24.92	4.74	-95.91	25.33	0.33	71.54	-23.00	72.53	78.71	35.5658	Key wells
5	29.9058	74.4177	Sangariya	SANTPURA	8.1	2800	48.27	5.10	-11.35	48.72	0.93	66.57	-1.39	14.27	17.53	11.5324	Key wells
6	29.8744	74.51	Sangariya	DHABAN	8.11	5600	40.72	5.50	-23.23	43.22	0.69	56.28	-5.21	21.31	31.47	8.6174	Key wells
7	29.7816	74.4619	Sangariya	SANGARIYA	7.99	1600	22.73	1.44	-5.97	25.56	0.29	74.94	3.00	1.01	9.75	2.2346	Key wells
8	29.7194	74.4716	Sangariya	NAGRANA	8.44	2400	68.21	8.45	-0.56	68.52	2.15	74.23	4.80	1.94	12.00	0.5781	Key wells
9	29.7102	74.3769	Sangariya	LILANWALI	8.47	1400	74.25	7.77	4.17	74.65	2.88	72.48	4.80	-3.34	7.61	0.0459	Key wells

10	29.7143	74.3358	Sangariya	KIKARWALI	8.07	7890	59.18	11.67	-26.42	59.47	1.45	72.85	-2.80	31.77	38.64	20.0118	Key wells
11	29.4511	74.308	HANUMANGARH	KISHANPURA	7.82	6650	37.69	5.52	-38.82	38.23	0.60	50.02	-18.00	23.76	28.23	36.9174	Key wells
12	29.4611	74.4097	HANUMANGARH	MUNDA	8.54	920	24.03	1.23	-3.56	25.93	0.32	76.19	1.00	-0.04	5.06	0.0834	Key wells
13	29.3422	74.3772	HANUMANGARH	LAKUWALI	7.92	860	21.75	1.05	-1.59	24.88	0.28	77.76	4.01	0.49	6.28	1.1249	Key wells
14	29.3419	74.5622	rawatsar	BHURANPURA	7.99	520	27.74	1.08	-1.96	29.57	0.38	39.45	-0.40	-0.70	2.41	2.8243	Key wells
15	29.3986	74.4886	Tibi	DABLI KHURD	7.52	1800	47.84	3.97	-3.99	48.76	0.92	55.24	1.19	1.95	8.68	3.8481	Key wells
16	29.485	74.5241	Tibi	SILWALA	8.01	2600	55.08	5.91	-6.02	55.57	1.23	70.76	2.21	2.98	10.48	5.8851	Key wells
17	29.5991	74.5402	Tibi	SUREWALA	8.02	2370	29.16	2.40	-10.61	29.86	0.41	68.24	0.99	5.50	12.55	4.5130	Key wells
18	29.6502	74.5036	Tibi	BASHIR	8.25	1200	63.64	5.21	2.58	63.83	1.75	81.90	6.20	-2.52	6.47	1.2034	Key wells
19	29.6144	74.4347	Tibi	PANNIWALI	8.38	2700	45.96	4.63	-7.83	46.50	0.85	64.93	0.19	0.79	10.45	0.2053	Key wells
20	29.6405	74.2286	HANUMANGARH	JANDAWALI	8.41	5380	39.60	5.31	-24.42	40.00	0.66	63.44	-5.20	19.32	28.20	0.4583	Key wells
21	29.6913	74.2386	HANUMANGARH	HIRANWALI	8.1	7200	68.54	14.71	-8.01	68.67	2.18	64.93	6.80	21.03	37.26	6.3285	Key wells
22	29.7213	74.0964	HANUMANGARH	UTTAMSINGHWALA	8.48	2800	32.93	3.04	-11.61	33.70	0.49	69.81	1.00	3.31	13.92	0.3736	Key wells
23	29.7178	74.0214	Pilibanga	UMEWALA	8.05	1100	32.95	1.89	-3.04	33.92	0.49	73.09	2.39	-1.93	4.98	2.4660	Key wells

24	29.6455	74.9719	Pilibanga	AMARSINGWALA	8.12	15600	55.11	14.52	-63.99	55.39	1.23	57.14	-24.00	117.26	121.65	41.1308	Key wells
25	29.6202	74.8861	Pilibanga	KHIOTHANWALI	7.79	1490	19.02	1.17	-4.80	20.74	0.23	59.70	2.61	0.01	9.01	1.6822	Key wells
26	29.6619	74.1141	Pilibanga	PAKKA BHADWA	7.88	12290	57.66	13.88	-45.98	57.92	1.36	53.83	-18.00	60.10	66.47	31.9497	Key wells
27	29.6486	74.1514	Hanumangarh	Malkoka	7.98	2360	72.08	9.48	3.26	72.31	2.58	73.28	8.20	4.48	14.76	2.2534	Key wells
28	29.6078	74.1705	Hanumangarh	Noorpura	8.16	3700	40.29	4.60	-16.81	40.82	0.67	74.14	0.39	21.28	27.18	8.3127	Key wells
29	29.6122	74.1067	Hanumangarh	Ayalki	8.28	1680	59.41	5.41	-1.23	60.10	1.46	59.02	2.81	4.30	9.95	3.2554	Key wells
30	29.6178	73.9766	Hanumangarh	Hardyalpura	7.97	910	16.29	0.77	-4.62	17.64	0.19	46.30	-1.00	-0.20	4.09	3.0721	Key wells
31	29.5897	74.0247	Hanumangarh	Hansaliya	8.93	2030	91.85	20.16	7.21	91.88	11.27	75.02	7.21	1.70	10.78	0.1316	Key wells
32	29.5214	74.9722	Hanumangarh	Thirajwala	8.02	5510	68.29	14.02	-16.40	68.53	2.15	67.93	-2.00	49.49	51.69	21.1578	Key wells
33	29.5167	74.0167	Hanumangarh	Sundarsinghwala	8.06	3600	81.53	16.27	-0.40	81.86	4.41	82.34	5.19	18.47	23.68	7.9167	Key wells
34	29.4961	74.0917	Hanumangarh	Pilibanga	8.12	2000	35.20	2.83	-4.80	37.16	0.54	44.15	1.20	8.32	15.70	2.1121	Key wells
35	29.5478	74.0917	Hanumangarh	Loungwala	8.24	2600	60.35	7.00	-3.77	60.66	1.52	84.86	5.20	8.35	15.70	4.6653	Key wells
36	29.5964	74.2418	Hanumangarh	Makasar	8.27	1080	68.01	5.70	4.79	68.30	2.13	38.87	6.19	-3.25	-1.01	0.4467	Key wells
37	29.5378	74.1786	Hanumangarh	Dablirathan	7.98	8190	51.56	9.62	-35.66	51.81	1.06	60.83	-10.80	27.28	33.19	25.0358	Key wells

38	29.5139	74.1083	Hanumangarh	Dulmana	8.23	540	34.44	1.53	1.17	35.79	0.53	52.63	3.39	-5.47	2.14	0.3117	Key wells
39	29.46	74.0161	Hanumangarh	Dingwala	7.82	5180	46.64	6.49	-21.01	47.41	0.87	53.64	-6.19	39.38	42.19	10.9388	Key wells
40	29.4367	74.9539	Hanumangarh	Prempura	8.18	1080	41.73	2.56	-2.37	42.59	0.72	52.93	1.00	5.00	5.61	2.8255	Key wells
41	29.4175	74.0139	Hanumangarh	Saramsar	8.60	1885	80.12	11.08	3.83	80.43	4.03	52.32	4.81	6.28	10.49	0.1668	Key wells
42	29.3569	74.0725	Hanumangarh	Badopal	8.27	5200	88.30	25.36	15.75	89.48	7.55	78.74	20.19	10.07	37.28	1.9838	Key wells
43	29.4011	74.1	Hanumangarh	Daulatwali	8.37	1020	35.05	1.94	-4.84	36.20	0.54	47.24	-2.60	3.09	5.01	0.1685	Key wells
44	29.5417	74.2544	Hanumangarh	Ramsaranarayan	7.62	3080	50.02	5.56	-10.42	50.63	1.00	89.63	3.40	11.76	20.41	7.2053	Key wells
45	29.4789	74.1469	Hanumangarh	Bahlolnagar	8.00	4440	64.32	9.94	-9.00	64.77	1.80	55.24	-0.60	19.45	26.11	9.4958	Key wells
46	29.3436	74.2086	Hanumangarh	Jakharnwali	7.97	530	21.29	0.84	-0.63	22.90	0.27	46.08	1.60	0.38	2.62	0.7256	Key wells
47	29.3436	74.3147	Hanumangarh	Jorawarpura	7.86	350	14.69	0.47	-0.20	16.94	0.17	63.03	2.19	-0.71	1.11	0.3847	Key wells
48	29.3658	74.3463	Hanumangarh	Mainawali	8.36	915	44.56	2.64	-2.61	45.56	0.80	59.33	0.00	-1.21	3.99	0.1736	Key wells
49	29.4164	74.3653	Hanumangarh	Matoriyawalidhani	7.62	3640	33.45	3.50	-16.42	34.05	0.50	20.73	-11.40	7.15	16.47	5.8998	Key wells
50	29.4383	74.2752	Hanumangarh	Araiyanwali	7.78	6560	60.78	11.26	-19.78	61.09	1.55	39.32	-9.41	32.36	40.04	14.8147	Key wells
51	29.5578	74.4639	Hanumangarh	Salemgarh	8.15	790	27.36	1.28	-0.38	28.73	0.38	82.68	4.39	-0.24	4.76	0.7453	Key wells

52	29.5639	74.3922	Hanumangarh	Nandram ki dhani	8.30	2660	54.43	5.90	-4.99	54.73	1.19	68.84	2.81	10.32	17.03	0.4874	Key wells
53	28.86056	74.16306	Rawatsar	Ladam	7.89	4560	85.94	21.87	1.60	85.98	6.11	46.91	4.60	35.31	6.81	7.6703	Key wells
54	28.81861	74.13	Rawatsar	Ghaniyasar	7.61	276	11.85	0.31	-0.98	14.89	0.13	38.16	0.01	0.53	1.23	1.3263	Key wells
55	28.97639	74.28028	Rawatsar	Mehraon Ki Dhani	7.53	260	15.17	0.37	-0.58	18.95	0.18	45.14	0.41	0.14	-0.25	0.9973	Key wells
56	28.91833	74.39167	Rawatsar	Dewasar	7.64	270	10.40	0.27	-0.62	12.69	0.12	31.37	0.20	-0.05	1.44	0.7417	Key wells
57	29.22889	74.28889	Rawatsar	Khoda	7.74	1790	22.89	1.65	-4.77	25.99	0.30	79.19	7.41	5.56	15.74	1.2376	Key wells
58	29.30389	74.27194	Rawatsar	Bhairtsari	7.70	3780	52.60	6.73	-8.02	53.03	1.11	50.05	1.19	13.84	24.69	4.4092	Key wells
59	29.26583	74.26167	Rawatsar	Khedasari	8.02	1160	45.61	2.96	-0.61	46.53	0.84	58.20	3.01	3.67	-3.31	1.5118	Key wells
60	29.17667	74.33833	Rawatsar	Keshardeshar	8.06	1980	57.05	5.37	-0.58	57.86	1.33	63.34	4.61	8.86	-8.16	2.2419	Key wells
61	29.12444	74.18889	Rawatsar	Bangasar	7.94	1960	55.87	5.14	3.95	58.59	1.27	70.88	9.80	0.00	12.11	0.7388	Key wells
62	29.04694	74.15306	Rawatsar	Dhandhusar	8.09	3020	58.09	7.07	-1.62	58.90	1.39	70.81	7.59	7.17	5.81	1.4311	Key wells
63	29.21833	74.16417	Rawatsar	Motar	8.20	867	54.92	3.46	2.16	58.09	1.22	65.29	4.80	-3.40	3.30	0.6075	Key wells
64	28.95361	74.16028	Rawatsar	Daniyasar	7.91	7980	81.54	24.00	-7.38	81.59	4.42	70.21	2.99	49.49	63.31	13.6190	Key wells
65	28.96806	74.10778	Rawatsar	Shirasar	8.20	277	10.43	0.28	-0.79	12.90	0.12	33.05	0.20	-0.15	2.02	0.8463	Key wells

66	29.02611	74.38778	Rawatsar	Jhedasar	7.82	1040	14.46	0.69	-4.63	16.02	0.17	48.98	-0.59	2.46	6.32	2.6091	Key wells
67	28.98472	74.41861	Nohar	Kansar	8.06	2820	46.30	4.78	-9.38	47.10	0.86	70.09	1.40	4.78	20.05	3.7131	Key wells
68	29.07583	74.44528	Rawatsar	Nyolakhi	7.80	4200	62.23	9.27	-12.83	62.59	1.65	16.63	-10.20	10.74	16.42	20.4545	Key wells
69	29.16278	74.43611	Rawatsar	Rampura	7.77	4380	41.12	5.02	-21.44	41.60	0.70	49.69	-8.61	37.51	22.17	14.5045	Key wells
70	29.21056	74.41778	Rawatsar	4DWM	7.94	546	15.39	0.58	-0.63	19.05	0.18	72.12	2.99	-1.40	3.95	0.5786	Key wells
71	29.28	74.4775	Rawatsar	Chaiya	8.00	5150	49.24	6.99	-20.61	49.71	0.97	55.39	-6.21	17.84	25.33	13.4798	Key wells
72	29.2925	74.57083	Nohar	Thalarka	7.66	1110	42.87	2.68	0.02	43.77	0.75	52.93	3.39	-0.05	6.76	1.1625	Key wells
73	29.27944	74.62583	Nohar	Dhandhela	8.08	1490	14.26	0.82	-3.23	21.68	0.17	56.78	3.60	4.33	4.19	0.9880	Key wells
74	29.31111	74.69944	Nohar	Lalkhan ki Dhani	8.13	240	10.70	0.25	-0.18	12.54	0.12	26.47	0.40	-0.40	-7.55	0.3493	Key wells
75	29.29806	74.69528	Nohar	Deidas	7.55	253	9.98	0.24	-0.35	11.71	0.11	48.98	0.80	0.07	-27.32	0.4941	Key wells
76	29.15139	74.37611	Rawatsar	Poharka	8.24	1910	85.51	13.87	7.43	85.62	5.90	56.58	9.00	3.27	9.32	1.3197	Key wells
77	29.04528	74.44528	Rawatsar	Hamirdeshar	7.95	527	86.03	7.78	4.01	86.14	6.16	24.76	4.20	-7.77	-113.51	0.2164	Key wells
78	29.03028	74.50167	Nohar	Thairana	7.98	3130	67.12	8.84	0.02	70.02	2.04	65.86	6.19	15.90	2.55	3.1363	Key wells
79	28.90556	74.47528	Nohar	Sirangsar	7.52	262	23.34	0.61	0.00	25.53	0.30	69.98	1.40	-0.56	-79.59	0.4924	Key wells

80	28.94306	74.56028	Nohar	Khuia	7.50	282	15.21	0.40	-0.23	16.71	0.18	33.96	0.60	-0.23	-20.47	0.4576	Key wells
81	28.86639	74.52444	Nohar	Dhansiya	7.98	3113	54.20	6.04	-6.04	59.96	1.18	66.26	2.60	6.58	23.49	3.0126	Key wells
82	28.84278	74.60361	Nohar	Bhawalsar	8.03	250	13.97	0.36	-0.21	15.51	0.16	75.11	1.60	-0.15	-39.65	0.4499	Key wells
83	28.92333	74.64222	Nohar	Jokhasar	7.96	4600	85.22	21.24	-1.98	85.26	5.77	55.79	1.80	37.77	26.06	13.9987	Key wells
84	28.98694	74.70583	Nohar	Sangthiya	7.55	264	7.65	0.19	-0.43	9.29	0.08	31.37	0.40	0.14	-10.05	0.4576	Key wells
85	29.10167	74.7275	Nohar	Ararki	7.70	12530	94.58	66.06	7.04	94.63	17.46	80.45	12.80	106.84	110.05	13.5550	Key wells
86	29.22139	74.89889	Nohar	Parlika	7.73	450	10.63	0.34	-2.83	12.95	0.12	55.24	-0.60	0.03	1.80	4.5352	Key wells
87	29.28833	74.89194	Nohar	Gudiya	7.95	9130	55.84	11.37	-36.01	56.03	1.26	64.36	-10.01	55.07	59.58	32.2429	Key wells
88	29.33306	74.90028	Nohar	Phephana	7.96	1400	1.32	0.08	-12.80	2.09	0.01	17.27	-10.01	0.01	3.99	6.2443	Key wells
89	29.35194	74.85083	Nohar	Charanwasi	7.85	3140	68.16	9.84	-5.56	68.41	2.14	54.55	0.20	11.47	17.46	8.9254	Key wells
90	29.35	74.80389	Nohar	Raytanpura	7.67	13250	88.12	41.73	-11.83	88.18	7.42	60.83	-2.20	110.93	109.46	52.8130	Key wells
91	29.24083	74.51972	Rawatsar	Kanwani	8.05	5764	69.54	13.37	-11.54	70.15	2.28	72.00	0.81	47.55	27.07	14.5550	Key wells
92	29.17361	74.68722	NOHAR	ASARJANA	7.47	390	11.27	0.33	-1.62	13.28	0.13	64.93	0.60	0.78	2.43	1.8224	Key wells
93	29.14167	74.61361	NOHAR	BIRKALI	7.5	41830	63.72	30.62	-141.92	63.83	1.76	60.51	-50.00	248.91	259.83	66.9649	Key wells

94	29.09167	74.59806	NOHAR	ANANUA	8.48	1600	63.88	6.13	6.40	64.26	1.77	46.65	6.00	1.95	12.98	0.0347	Key wells
95	29.05528	74.65694	NOHAR	GPRKHANA	8.19	440	46.16	1.89	-0.43	47.24	0.86	50.71	0.80	-1.22	1.52	1.9705	Key wells
96	29.02	74.64	NOHAR	MANDARPURA	8.28	2400	73.89	10.09	2.03	74.04	2.83	68.56	6.39	3.57	14.52	2.7318	Key wells
97	28.95583	74.61222	NOHAR	RANISAR	8.42	500	83.86	6.62	2.19	83.91	5.20	50.71	1.40	-3.30	-1.55	0.0238	Key wells
98	28.94194	74.76333	NOHAR	RATHUSAR	8.1	1420	72.93	7.61	0.01	73.02	2.69	59.86	2.40	5.21	8.13	4.2548	Key wells
99	28.98917	74.83611	NOHAR	MEGHANA	7.66	7580	32.28	4.67	-45.58	37.41	0.48	45.80	-23.61	46.19	51.14	48.6347	Key wells
100	29.03583	74.80583	BHADRA	DOLAWALA BAS	8.13	6860	77.42	19.14	-8.37	77.48	3.43	66.60	2.00	29.06	36.84	13.9550	Key wells
101	29.11778	75.1625	BHADRA	BHADRA	8.19	520	6.02	0.21	-2.01	7.63	0.06	64.42	1.61	0.83	4.44	1.0817	Key wells
102	29.17111	75.17639	BHADRA	BHOJASAR	8.4	790	49.45	2.84	1.38	50.31	0.98	52.63	2.00	-3.34	4.17	0.0278	Key wells
103	29.23306	74.17861	BHADRA	SIRDARPURA BAS	7.33	30000	64.65	26.62	-101.93	64.91	1.83	61.29	-37.00	248.21	249.13	121.9940	Key wells
104	29.22111	75.26028	BHADRA	SAHUWALA	8.01	600	15.42	0.58	-3.62	16.65	0.18	64.07	-0.41	1.75	3.21	5.3337	Key wells
105	29.24389	75.37083	BHADRA	MAHRANA	7.98	7190	70.06	15.39	-16.82	70.34	2.34	44.52	-7.20	21.84	27.85	23.1152	Key wells
106	29.24389	75.37083	BHADRA	BIRAN	7.97	750	7.46	0.30	-5.40	8.30	0.08	65.75	-0.79	2.78	4.41	6.0699	Key wells
107	29.19417	75.38861	BHADRA	JHANSAL	7.78	1320	24.46	1.46	-6.40	26.27	0.32	72.57	1.00	4.97	9.12	3.9821	Key wells

108	29.08556	75.32056	BHADRA	SAGRA	8.42	2190	69.33	8.44	7.05	69.35	2.26	62.65	9.01	-4.17	14.24	0.0526	Key wells
109	26.04861	75.435	BHADRA	DABRI	8.23	600	31.48	1.30	-1.78	33.72	0.46	49.69	0.20	-10.04	1.85	2.7593	Key wells
110	29.02333	75.30556	BHADRA	AJEETPURA	8.01	500	19.24	0.69	-2.00	20.36	0.24	66.65	0.80	-0.10	2.65	2.2293	Key wells
111	29.03111	75.31806	BHADRA	JOGIWALA BAS	8.07	370	18.95	0.57	-2.17	20.76	0.23	66.39	-0.20	-0.20	1.25	5.7786	Key wells
112	29.15667	75.03639	BHADRA	GOGAMEDI	7.96	460	14.25	0.48	-0.79	15.38	0.17	57.00	1.59	-0.17	3.06	0.7036	Key wells
113	29.02333	75.05139	BHADRA	RASALNA	7.8	9320	79.18	23.78	0.43	79.24	3.80	67.29	13.60	57.11	74.44	5.9611	Key wells
114	29.02472	74.98111	BHADRA	GHEU	8.14	690	20.19	0.89	-4.38	20.99	0.25	61.20	-0.60	4.45	5.11	5.3444	Key wells
115	28.99611	74.91556	BHADRA	KANAU	7.79	400	7.55	0.24	-2.16	8.99	0.08	71.17	0.80	0.27	2.58	2.0477	Key wells
116	28.96694	74.95028	BHADRA	KANJI	7.85	390	9.20	0.28	-1.98	11.02	0.10	63.03	0.40	0.47	2.49	2.1408	Key wells
117	28.9525	75.7525	BHADRA	RAMASAR	7.81	350	12.88	0.41	-2.22	14.00	0.15	58.14	0.01	-1.18	1.76	2.7839	Key wells
118	28.83889	75.07639	BHADRA	MUNDARIABARA	8.19	5000	61.89	10.06	-6.97	62.00	1.62	68.70	6.20	21.00	35.43	4.6794	Key wells
119	28.89778	75.11833	BHADRA	ALAILA	7.92	470	15.71	0.55	-2.83	16.89	0.19	59.40	-0.19	0.07	2.28	3.6860	Key wells
120	28.94472	75.13139	BHADRA	KIRAN BARA	7.7	520	23.10	0.87	-2.59	24.51	0.30	66.65	0.21	-0.39	2.13	3.7498	Key wells
121	28.98833	75.13778	BHADRA	KALANA	8.31	2900	78.71	12.99	1.02	78.76	3.70	54.65	2.40	12.13	18.47	0.1722	Key wells

122	29.02472	74.98111	RAWATSAR	JHEDHASAR	8.38	940	12.98	0.60	-5.75	15.08	0.15	53.44	-2.19	0.38	3.73	0.1428	Key wells
123	28.99611	74.91556	NOHAR	SIRONGSAR	8.07	5850	52.80	7.61	-7.56	57.91	1.12	56.83	5.61	24.37	43.64	3.2595	Key wells
124	28.96694	74.95028	RAWATSAR	LALGASHIYA	8.38	2600	86.04	16.61	4.96	86.09	6.16	72.48	5.20	5.99	14.86	0.1157	Key wells
125	29.233	74.75	NOHAR	BHUKARKA	8.2	1400	48.63	3.74	-4.25	49.48	0.95	48.78	-0.44	6.90	9.57	5.3453	Key wells
126	29.075	74.3	RAWATSAR	BIRAMSAR	7.72	280	37.45	1.44	-1.13	39.45	0.60	38.02	-0.03	0.23	1.97	2.5996	NHS
127	28.867	74.278	RAWATSAR	BISRASAR	8.42	1315	40.04	2.85	-0.36	40.74	0.67	33.07	1.46	1.36	8.11	0.0563	NHS
128	29.838	74.41	SANGARIYA	BOLANWALI	7.34	310	28.02	0.94	-1.13	30.78	0.39	19.09	-0.58	-0.60	1.77	2.0250	NHS
129	29.625	74.508	TIBI	CHANDURWALA	7.72	290	29.56	1.03	-0.84	31.21	0.42	15.14	-0.39	-0.68	1.99	1.5148	NHS
130	29.359	74.599	TIBI	CHISTIAN	8	530	34.62	1.52	-0.94	36.93	0.53	33.03	0.41	0.94	2.89	1.5889	NHS
131	29.379	74.271	HANUMANGARH	CHOHLINYAWALI	8.1	315	31.01	1.06	-0.64	33.52	0.45	16.22	-0.19	-0.25	1.48	1.3803	NHS
132	29.183	74.342	RAWATSAR	DHANASAR	8.15	290	28.02	0.94	-1.13	30.66	0.39	34.57	-0.13	0.26	1.70	2.0048	NHS
133	29.758	74.267	HANUMANGARH	DHOLIPAL	7.5	2040	23.90	1.77	-9.15	27.62	0.31	46.29	-1.78	9.29	16.14	3.4315	NHS
134	28.908	74.133	RAWATSAR	DUDHAL	8.1	830	78.04	7.29	1.67	78.41	3.55	7.31	1.82	-1.06	4.12	2.1710	NHS
135	29.014	75.097	BHADRA	DUNGRANA	7.2	350	32.19	1.20	-0.84	32.56	0.47	20.44	-0.19	-0.89	2.22	1.5621	NHS

136	29.217	74.533	RAWATSAR	GANDEHALI	7.72	350	28.93	1.03	-0.84	29.37	0.41	26.68	0.01	0.22	2.30	1.5036	NHS
137	29.633	74.06	PILIBANGA	GOLUWALA	8.4	1400	76.85	8.66	5.96	77.62	3.32	36.86	6.01	-2.88	7.33	0.0581	NHS
138	29.583	74.317	HANUMANGARH	Hanumangarh	7.7	3350	54.87	6.66	-11.25	55.68	1.22	33.43	-6.23	16.17	20.60	12.4879	NHS
139	29.561	74.333	HANUMANGARH	KOHLA	7.43	260	35.18	1.29	-1.03	37.40	0.54	23.33	-0.38	-0.49	1.81	2.3043	NHS
140	29.563	73.971	PILIBANGA	LAKHASAR1	7.56	7300	81.28	23.40	-7.75	81.40	4.34	31.14	-3.23	48.28	53.62	17.1207	NHS
141	29.563	73.971	PILIBANGA	LAKHASAR1	7.56	7300	81.28	23.40	-7.75	81.40	4.34	31.14	-3.23	48.28	53.63	17.1459	NHS
142	29.033	74.733	NOHAR	LAKHASAR2	8.2	380	43.17	1.80	0.36	44.04	0.76	37.59	1.41	-1.65	1.60	0.9065	NHS
143	28.975	74.292	RAWATSAR	LAKHERAN	7.51	14420	73.14	23.29	-31.39	73.22	2.72	28.33	-21.04	104.33	107.52	41.2579	NHS
144	28.971	75.033	BHADRA	MALSISAR	7.9	1965	50.13	4.67	-5.73	50.71	1.01	42.67	-1.12	11.82	15.20	5.2037	NHS
145	29.1	75.033	BHADRA	MUNSARI	8	1460	65.47	6.12	-1.44	65.98	1.90	43.34	0.82	8.19	7.92	4.8503	NHS
146	29.281	74.767	NOHAR	NOHAR1	7.7	330	23.45	0.80	-1.24	24.75	0.31	25.13	-0.39	-0.41	2.28	1.6726	NHS
147	29.683	74.163	HANUMANGARH	PAKKASARNA	7.88	1100	79.97	8.94	3.05	80.19	3.99	6.18	3.21	3.92	2.72	2.0250	NHS
148	28.917	74.2	RAWATSAR	PALLU	7.53	300	32.89	1.22	-1.33	34.56	0.49	30.75	-0.38	-0.46	2.00	2.5550	NHS
149	29.413	74.2	PILIBANGA	PANDITAWALI	8.12	960	69.40	6.09	4.17	69.98	2.27	45.91	5.82	-3.27	5.62	0.7878	NHS

150	29.033	74.283	RAWATSAR	PURABSAR	7.65	4100	37.92	4.43	-23.77	38.77	0.61	48.54	-10.99	15.67	20.98	24.1082	NHS
151	29.25	74.833	NOHAR	RAMSARA1	8	8300	48.26	8.67	-29.99	48.76	0.93	30.66	-16.72	39.90	53.42	8.6634	NHS
152	29.85	74.45	SANGARIYA	RATANPURA	8.45	1110	73.33	7.07	5.06	74.02	2.75	34.94	3.82	-3.87	5.49	0.0235	NHS
153	29.253	74.414	RAWATSAR	RAWATSAR	8.09	310	30.27	1.06	-0.84	33.05	0.43	21.80	-0.19	0.10	1.72	1.5772	NHS
154	29.7	74.488	TIBI	SALEWALI	8	2780	67.58	9.09	-1.74	67.93	2.08	47.43	2.77	12.43	19.47	4.4004	NHS
155	29.625	74.317	HANUMAN GARH	SATIPURA	7.52	1400	59.55	5.06	0.86	60.22	1.47	40.76	3.27	2.49	8.77	1.8981	NHS