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

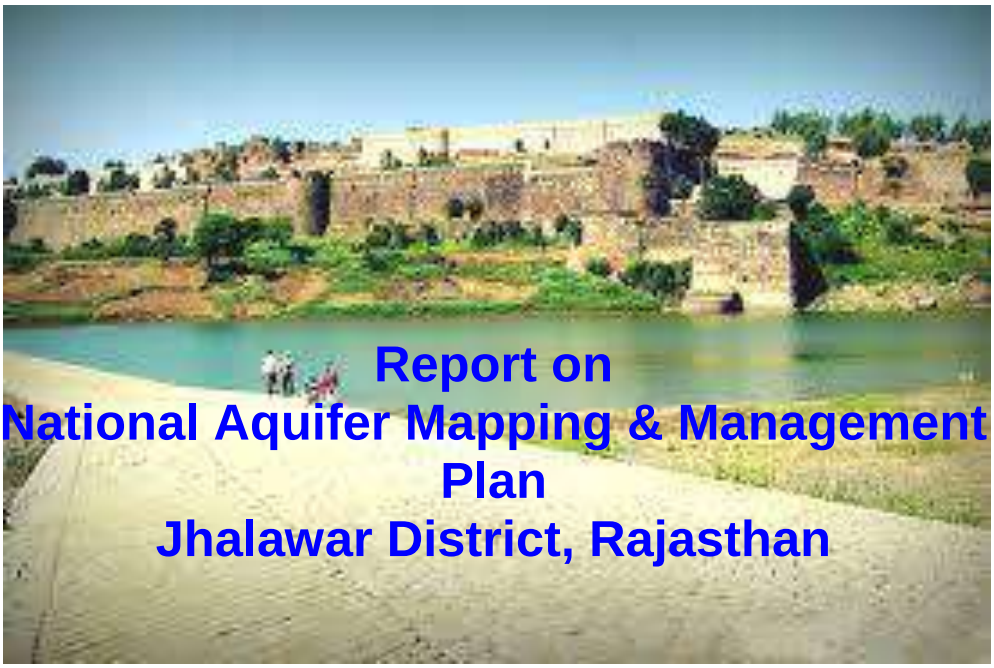
AQUIFER MAPPING AND MANAGEMENT OF GROUND WATER RESOURCES

JHALAWAR DISTRICT, RAJASTHAN

पश्चिमी क्षेत्र, जयपुर

Western Region, Jaipur

Government of India
Ministry of Jal Shakti
Water Resources, River development & Ganga Rejuvenation Department

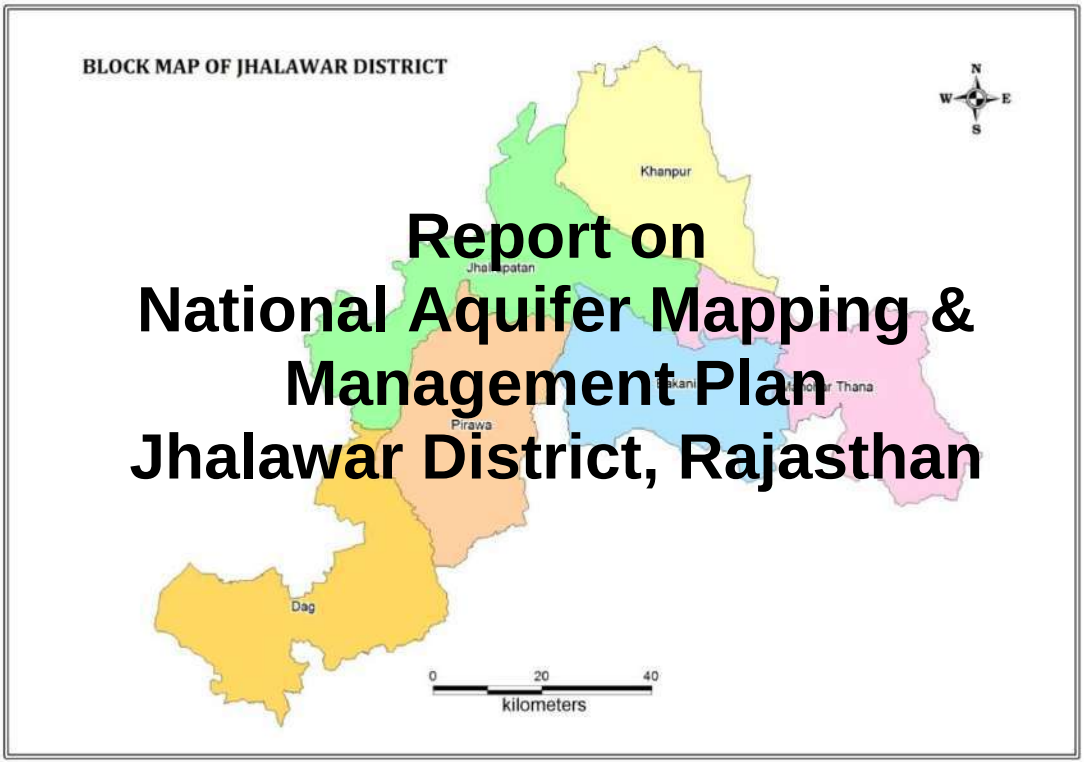


Report on
National Aquifer Mapping & Management Plan
Jhalawar District, Rajasthan

CENTRAL GROUND WATER BOARD
Western Region, Jaipur.

2019

Government of India
Ministry of Jal Shakti
Water Resources, River Development & Ganga Rejuvenation Department
Central Ground Water Board
Western Region Jaipur



Report on National Aquifer Mapping & Management Plan Jhalawar District, Rajasthan

Regional Director

Dr S.K.Jain

Report Compiled & Prepared

S.S.Saraswat
Scientist-D

JAIPUR
2019

National Aquifer Mapping & Management Plan Jhalawar District, Rajasthan (6253 Sq Km)

CONTENTS

LIST OFFIGURES

LIST OF PHOTOGRAPHS:

LIST OFTABLES:

LIST OF ANNEXURES:

National Aquifer Mapping & Management Plan Jhalawar District, Rajasthan

1.0 Introduction

The increasing water scarcity has become one of the most challenging problem for developing country like India*. Groundwater is a precious natural water resource considered as a readily available and safe source of water for domestic, agriculture and industrial uses. Our growing dependability on ground water has started diminishing this resource.* The most significant change in the groundwater scenario in India is that the share of bore well irrigation went up from a mere 1 percent during 1960-61 to 60 percent during 2006-07 as per Indian Agricultural Statistic, 2008. About 85% of the rural drinking water supply is also met from ground water sources. Thus a need was felt for scientific management of groundwater resources and the need has turned to urgency in the present times. There has been a paradigm shift from groundwater development to groundwater management over the last decade. The importance of groundwater for national development has deemed it necessary to be more specific; more general "groundwater management" has become "aquifer management" to answer the specific queries on availability and sustainability. CGWB has taken up National Project on Aquifer Management (NAQUIM) in XII & XIII Plan period to formulate sustainable aquifer management plan.

1.1 Purpose and Scope

Aquifer mapping is a scientific process wherein a combination of geological, geophysical, hydrological and chemical fields and laboratory analyses have been applied to characterized 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 changes 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.

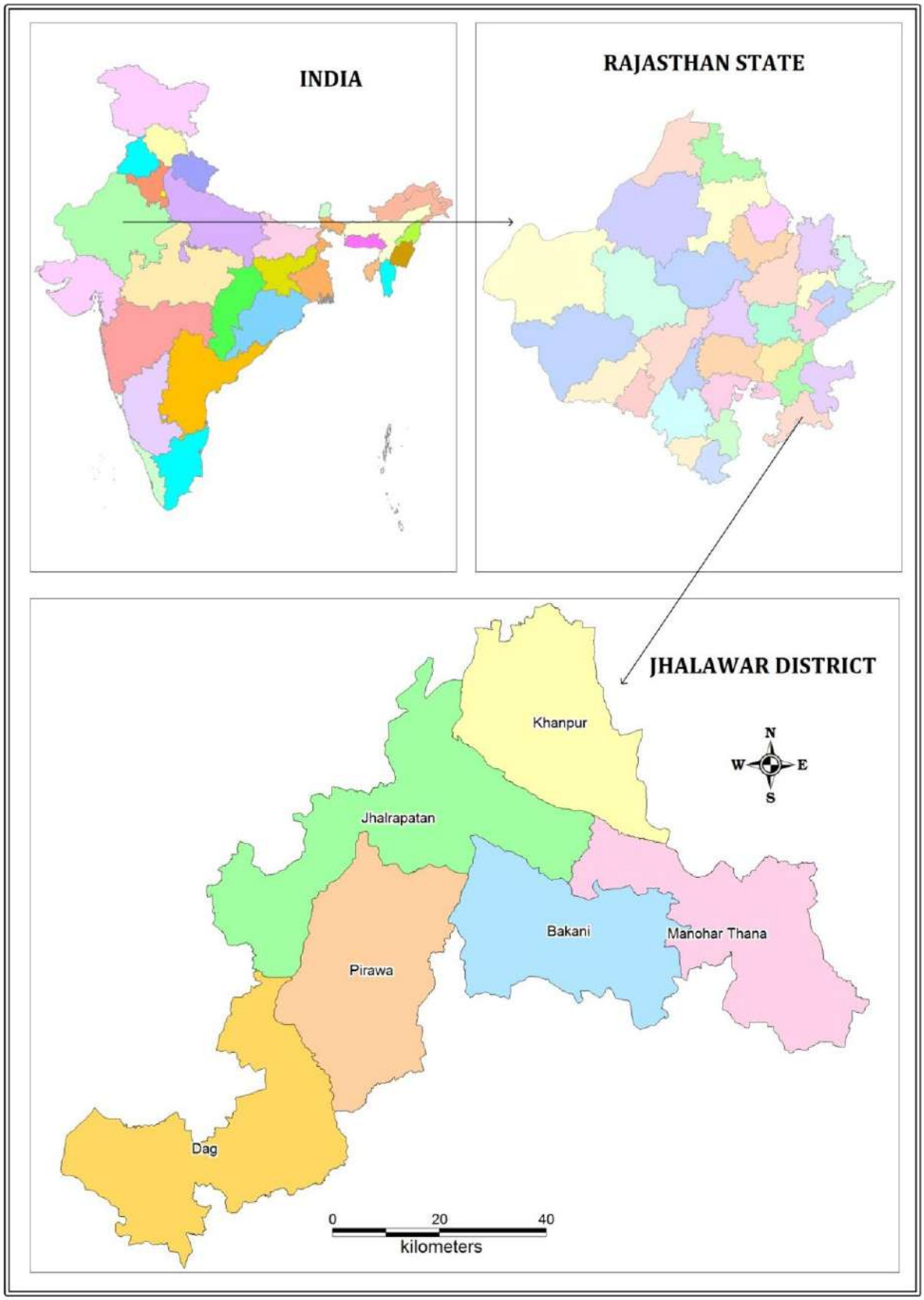
Under the National aquifer Programme, it is proposed to generate Aquifer Maps on 1:50000 scale, which basically aims at characterizing the aquifer geometry, behaviour of groundwater levels and status of groundwater development in various aquifer system to facilitate planning of their suitable management. The major activities involved in this process include compilation of existing data, identification of data gaps, generation of data for feeling data gaps and preparation of different aquifer layers.

To get a clear 3D hydro-geological geometry of the aquifer system and water level behaviour, it was felt to generate more data through Groundwater Exploration, VES and to establish more numbers of monitoring stations for better understanding of the groundwater regime behavior in terms of both quantity and quality.

The state of Rajasthan comprises 34 districts. Out of these, 25 districts have already reached the level of over-exploitation. Various developmental activities over the years have adversely affected the ground water regime in the State. In the state of Rajasthan, National Aquifer Mapping & Management Programme (NAQUIM) has been taken up in 14 districts during current (XII) five year plan in four phases and Jhalawar district has been covered in the first phase.

1.2 Location and Extent

Jhalawar district is located between 23^{o} 45' 20" and 24^{o}52'17" North latitude and 75^{o} 27'35" and 76^{o}56'48" East longitude covering an area of 6253 sq.km. The district is part of Kota Division and is divided into five sub-divisions namely Aklera, Khanpur, Jhalawar, Pirawa, and Bhawanimandi. Administratively the district is divided into 7 tehsils and 6 development blocks (Fig. 1). There are 1618 revenue villages and 8 urban towns in the district. Urban and rural population of the district is 2.29 and 11.82 lakh respectively.



(Source: CGWB)

Figure 1: Index map of Jhalawar District

1.3 Physiography and Drainage

The district lies at the edge of Malwa plateau, an area of low hills and shallow plains. The district falls in following 5 physical divisions (Figure 2):

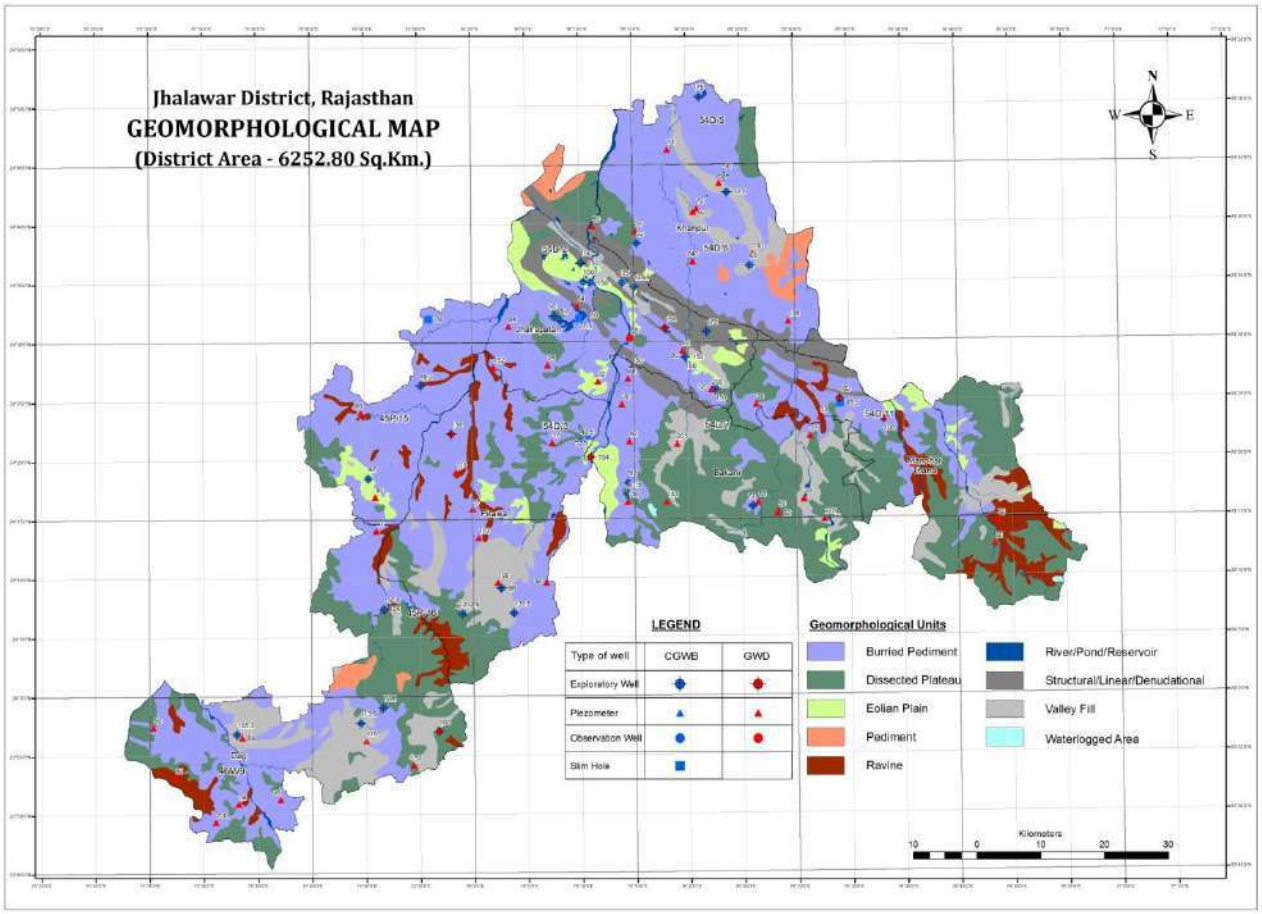
(1) The Mukandhara range

(2) The hills of Dag

(3) The plateau region with low rounded hills

(4) Central plains of Pachpahar and Jhalarapatan

(5) The plain of Khanpur between two arms of Mukandhara



(**Source: CGWB)**

Figure 2: Physiography and Drainage

The south Jhalawar has characteristics of the Malwa plateau, an area of rounded bare hills interspersed by plains. The Jhalawar plain stretches in a wide belt from Bhawani mandi in the west almost up to Asnawar in the east and is bounded in the northern, eastern and southern sides by the Mukandhara hills. Geomorphologically, the district is divided into

various units as described in Table 1.

Table 1: Geomorphic units in Jhalawar district

Origin	Land Forms	Occurrence in the District
Fluvial	Valley Fill	Scattered in the entire district, more concentrated in south, west and central.
	Ravine	Along rivers Parwan, Ahu, Kalisindh and their tributaries
Denudational origin	Pediment	In small patches mainly in west, north east and central
	Burried pediment	Main concentration in northern, central, western and south
Hill	Structural hill	In central part

Drainage: The rivers and streams of the entire district belong to the Chambal system. Except in the Gangdhar tehsil, the general flow is from south to north. The rivers of Jhalawar may be divided into two groups: the western group and eastern group. The western rivers are Ahu, Piplaj, Kyasri, Kantli, Rawa, Kalisindh and Chandrabhaga. The eastern rivers are Parwan, Andheri, Newaj, Ghar and Ujar. There are artificial lakes Kadila and Mansarovar. Generally speaking rivers have deep bed. With the result the water level is below that of the surrounding area. Drainage density in most part of the district varies from 0.5 to 0.7 km/km2. Drainage density is from 0.7 to more than 1 km/km2 in the southeastern and southwestern parts of the district. In the north central part of the district, it is low and ranges between 0.3 to 0.5 km/km2.

1.4 Climate and Rainfall

The climate of Jhalawar study area is mainly dry with very hot summer and cold winter

except during monsoon season when moist air of oceanic origin penetrates into the district. There are four seasons in a year. The hot weather season starts from mid March to last week of the June followed by the south-west monsoon which lasts upto September. The transition period from September to October forms the mild climate. The winter season starts late in November and remains up to first week of March.

Rainfall : The normal annual IMD (1901-1950) rainfall of the area is 1004 mm which is unevenly distributed over the area in 43 days. The south west monsoon , sets in from last week of June and withdraws in end of September, contributed about 93% of annual rainfall. July and August are the wettest months. Rest 7% rainfall is received during non-monsoon period in the wake of western disturbances and thunder storms. The heaviest one day rainfall recorded at Jhalawar is 1474 mm in 2012.

The annual rainfall of 30 years from 1989 to 2018 have been analyzed to know the behavior of rainfall (Fig.3). The analysis indicates that annual variation of rainfall is large and significant. The average annual rainfall from 1989 to 2018 is 851 mm. The highest rainfall of 61 % more than the average was recorded in 2012 whereas the lowest of 78% less than the average was experienced in 2002 as show in Table .

The standard deviation of rainfall from 1989 to 2018 is 294 mm which indicates that 557 mm rainfall is assured. The coefficient of variation of rainfall is 35%. It indicates that rainfall in the area is highly variable.

Table 2 : Frequency of Excess, Normal, Deficient and Scanty Rainfall (1989-2018)

Rainfall	No. of Years	Possibility of occurrence (per/year)
Excess	7	.23
Normal	12	0.4
Deficient	11	0.36

Table 2 (a) Drought Analysis – (1989-2018)

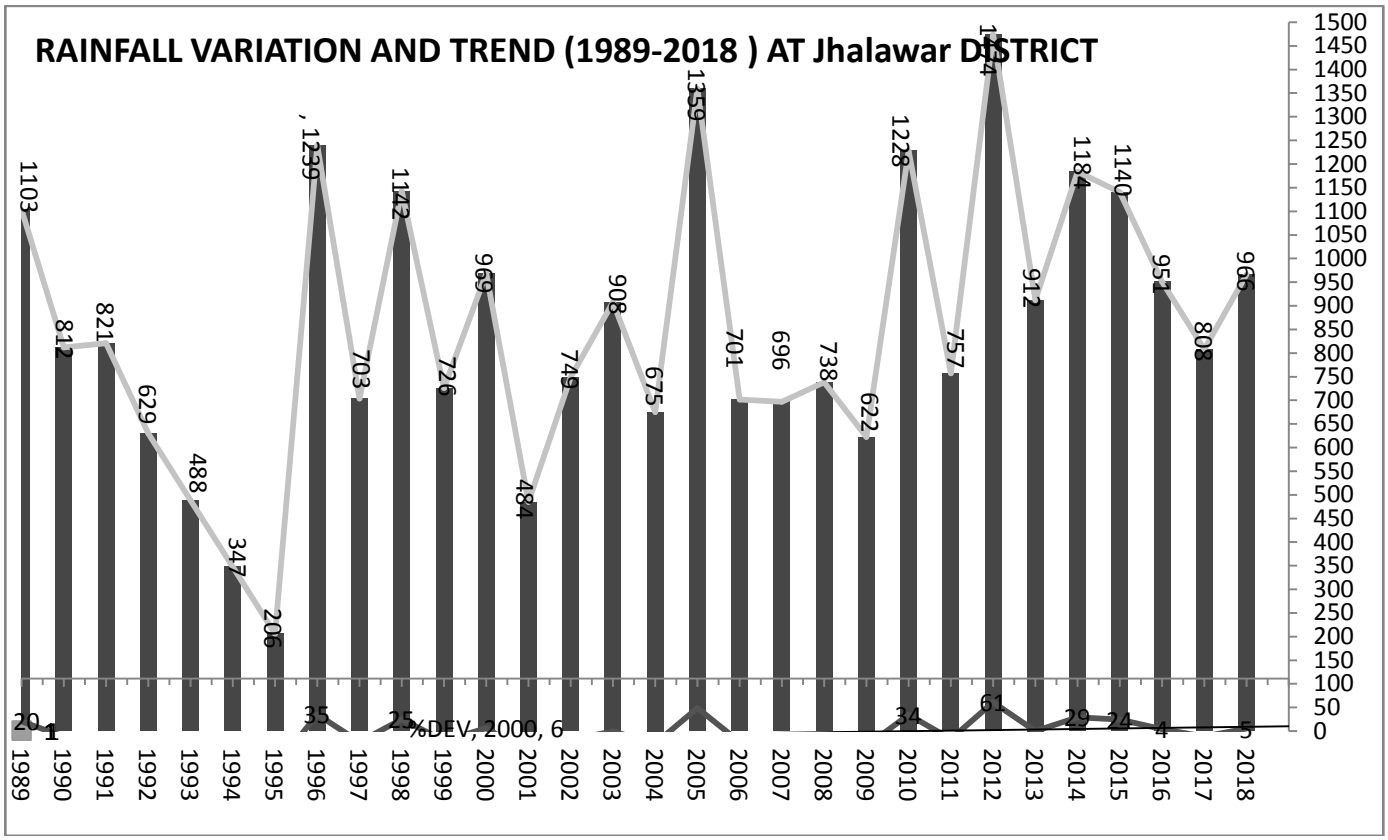
Drought	No. of Years	Possibility of occurrence
Mild	7	23%
Severe	4	13%

One severe drought is possible after 7 or 8 years.when deficit rainfall ranges betbeen-45 and-75% deviation from mean rainfall.

Table: 2 (b) Monthly Normal of Rainfall in mm

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec	Annual
Rainfall	11.8	5.6	3.8	3.4	7..9	106	359.2	311.1	158.5	14.5	15.3	7.6	1004.7
Rainy Days	1.1	0.50	0.5	0.3	0.8	5.6	13.5	11.9	7.2	1.0	0.9	0.6	43.9

Normal Annual rainfall = 1005 mm
Normal rainy days = 43.9
South west monsoon rainfall (June to September) =934.8 (93%)
Non Monsoon rainfall = 70.2mm (07%)



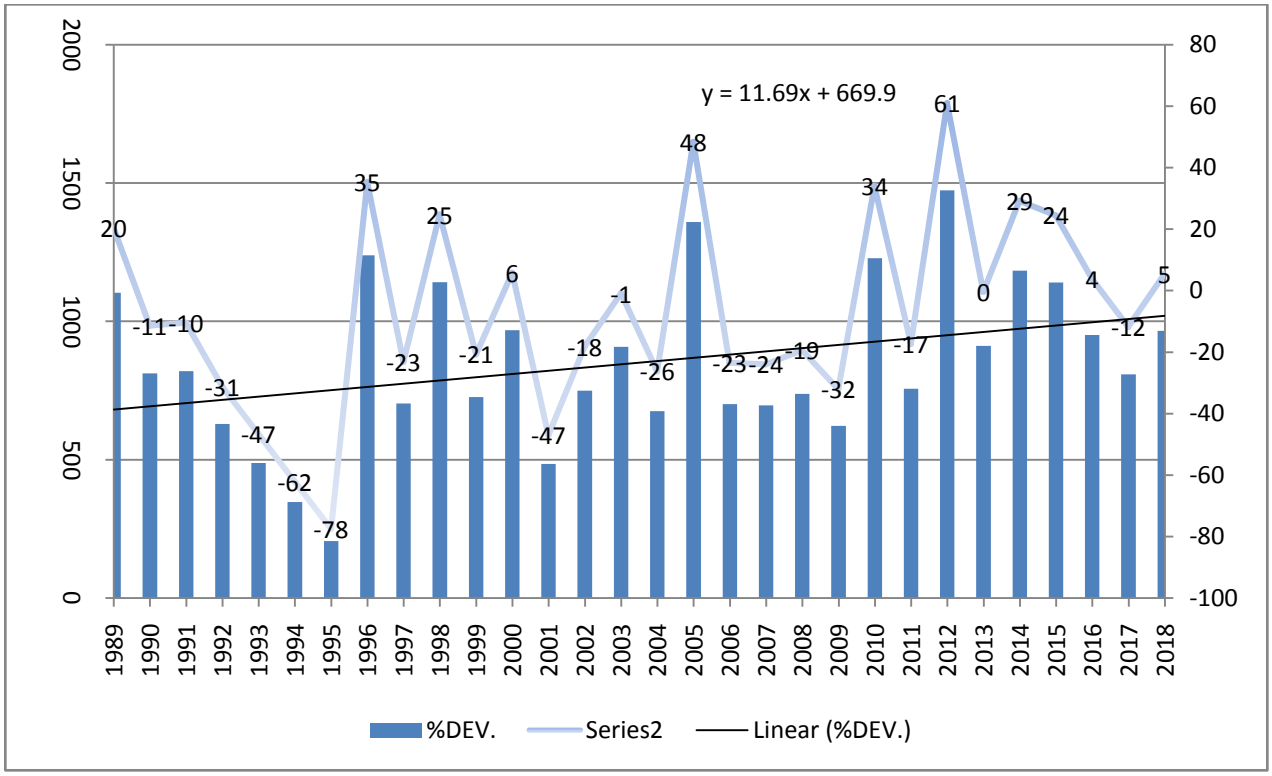


Fig.3: Long term behavior of rainfall

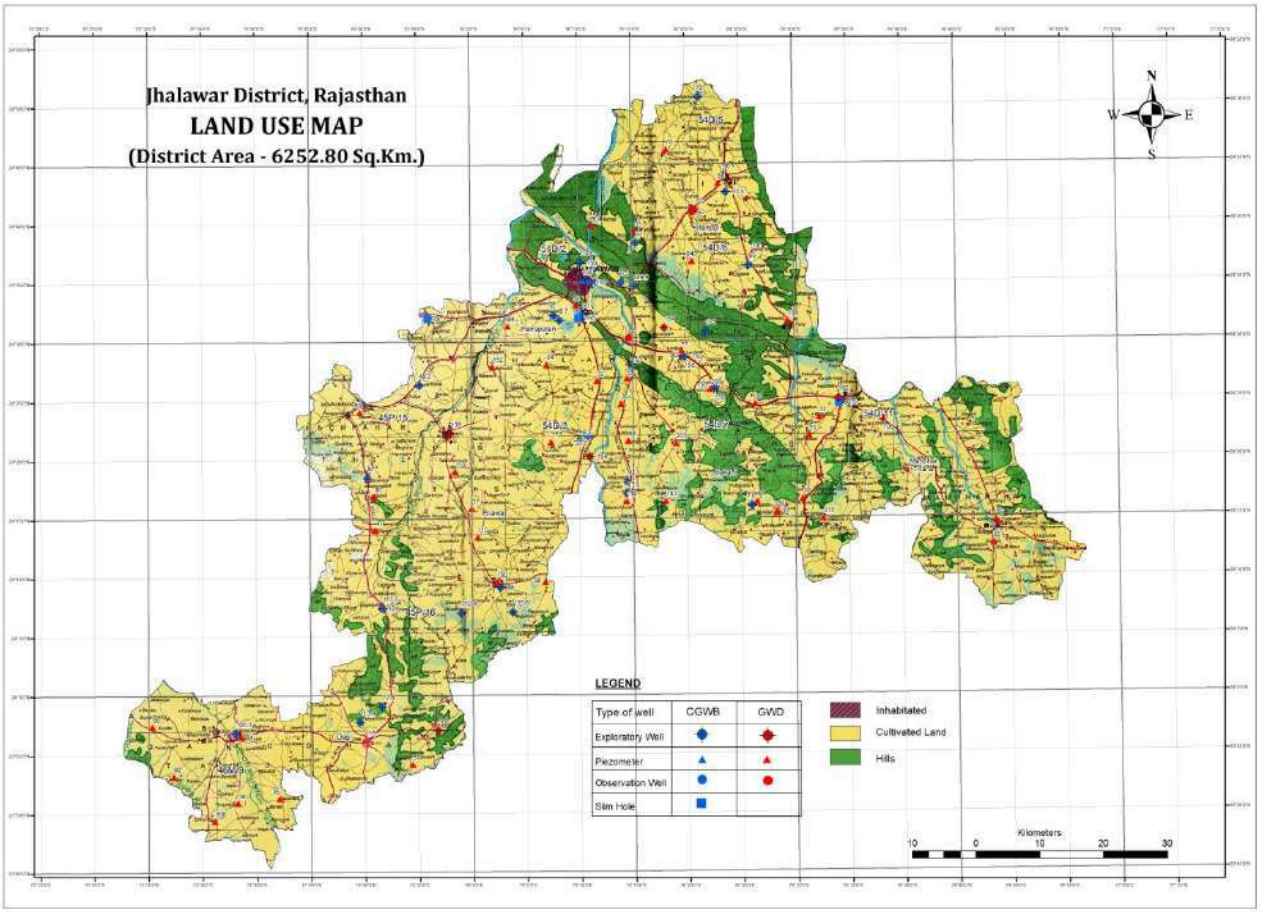
1.5 Soils & Land Use

1.5.1 Soils

Almost entire district is underlain by black cotton soil except for a few small pockets in the north of district where recent alluvium in plain area and lithosols and regosols are present.

1.5.2 Land Use

The net Forest Area in the Jhalawar district is 126276 hectares and Net Sown Area is 327958 hectares. The other uncultivable land excluding current fallow is 92478 hectares and fallow land is 23371 hectares as on 2010-11, Source: Dte. Of Economics & Statistics, Ministry of Agriculture, GOI)



. Fig. 4: Land Use cover of Jhalawar district.

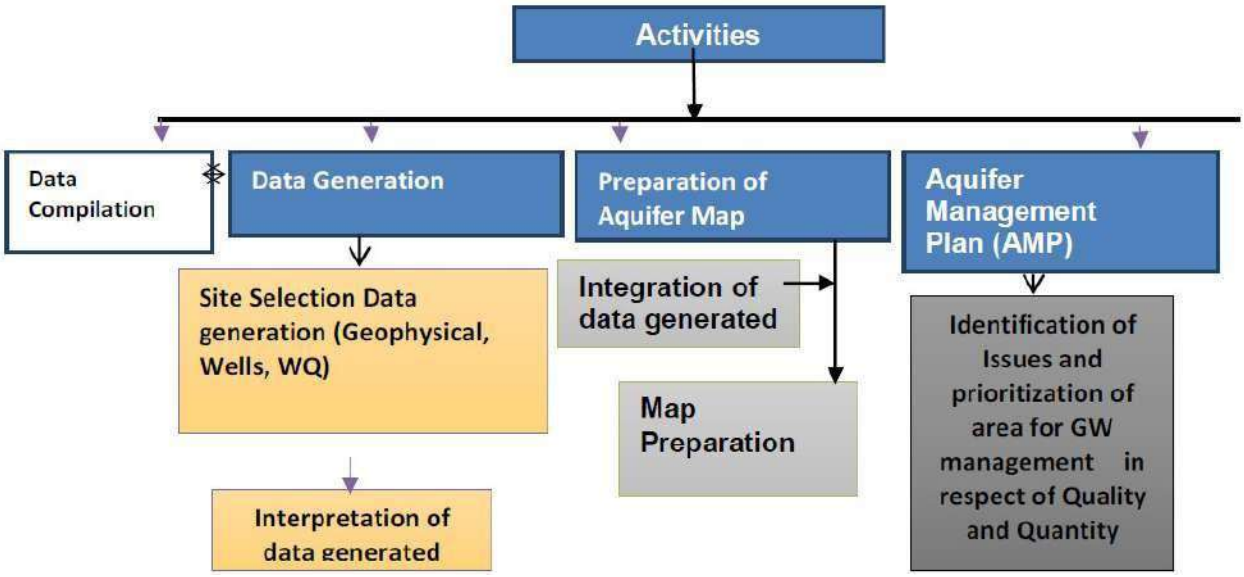
1.6: Objective, Scope of Study & Methodology:

The primary objective of the Aquifer Mapping Exercise can be summed up as “Know your Aquifer, Manage your Aquifer”. Demystification of Science and there by involvement of stake holders is the essence of the entire project. The involvement and participation of the community will infuse a sense of ownership amongst the stakeholders.

This is an activity where the Government and the Community work in tandem. Greater the harmony between the two, greater will be the chances of successful implementation and achievement of the goals of the Project. As per the Report of the Working Group on Sustainable Ground Water Management, “It is imperative to design an aquifer mapping programme with a clear-cut groundwater management purpose. This will ensure that aquifer mapping does not remain an academic exercise and that it will seamlessly flow into a

participatory groundwater management programme. The aquifer mapping approach can help integrate ground water availability with ground water accessibility and quality aspects.

Methodology: Various activities of NAQUIM are as follows:



Data Availability, Data Adequacy, Data Gap Analysis & Data Generation

The data of CGWB wells (Fig 5a & 5b) and Rajasthan ground water department in the area are plotted on the map of 1:50000 scale with 5'X5'grid (9 x 9km) respectively. The grids/ formations devoid of SH/PZ/EW were identified as data gaps and 10 EW & OW were constructed to fill the data gap However some more gaps are observed in the map which can be taken up in future programmes by data generation.

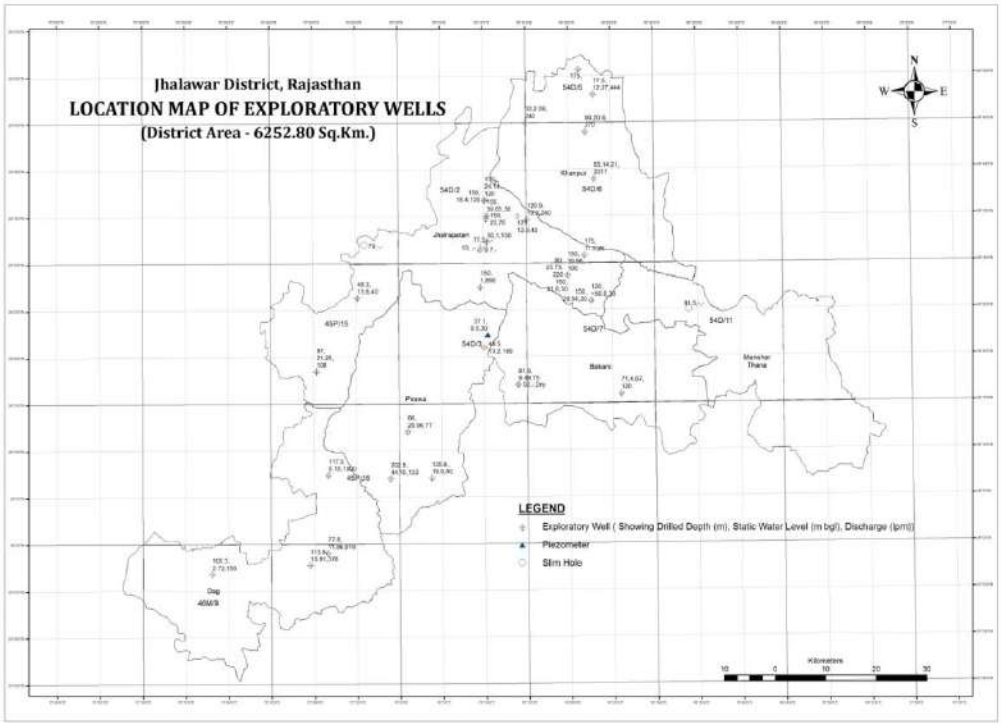


Fig 5 (a) : Location of CGWB Exploratory wells

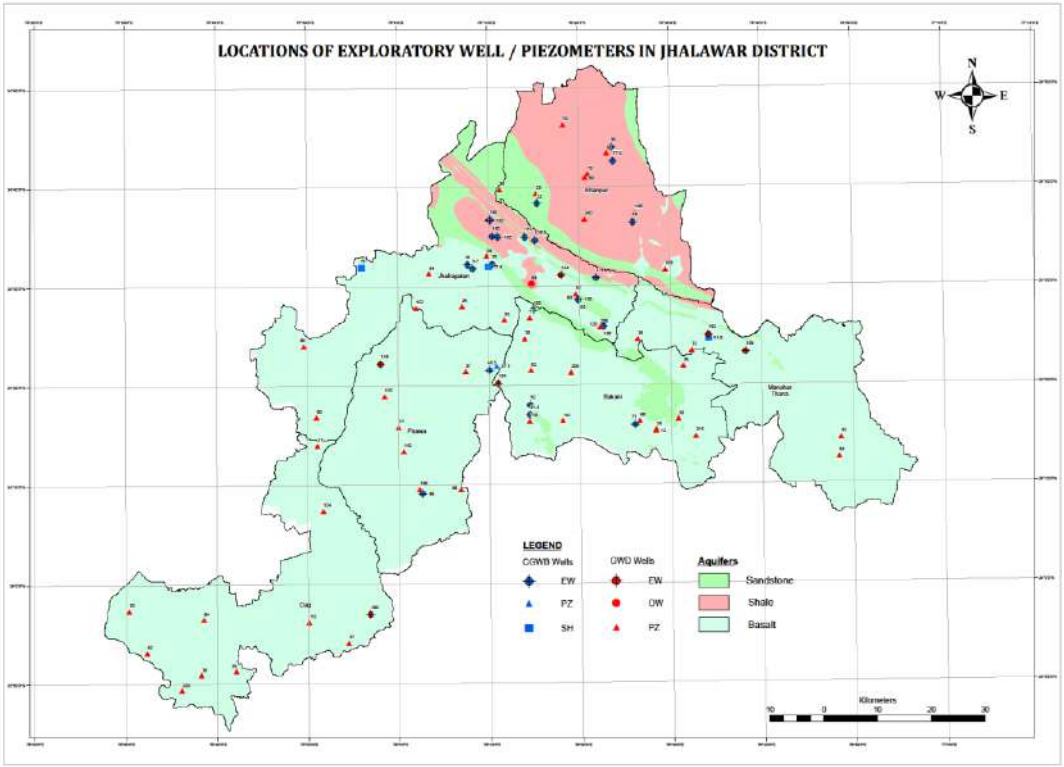


Fig 5 (b) : Location of CGWB & GWD Exploratory wells along-with aquifer system of the district.

2. DATA COLLECTION AND GENERATION

2.1 Data Collection

On the basis of available data of exploratory tube wells drilled by CGWB/GWD/PHED, the status of data were assessed and based on that, gaps were identified for data to be generated in respect of quality, quantity and lithology. Data pertaining to available statistics on cropping pattern and land under agriculture use was collected from statistic directorate for recommending the management plan of the available resource keeping in view of the prevailing cropping pattern.

A number of artificial surface structures are constructed by the Government of Rajasthan under MJSA (Mukhyamantri Jal Swablamban Abhiyan). The data of all the phases is collected and location map is also prepared.

The keywells were established for water level & sampling for quality of ground water during Pre-monsoon & Post-monsoon period and exploratory wells were drilled & constructed for knowing the subsurface aquifer parameters in the identified gaps.

2.2 Data Analysis

Data generation & collected from Ground Water Department, Government of Rajasthan, PHED and CGWB has been brought to a standard format and integrated location map have been prepared for groundwater monitoring, exploration, surface water and agriculture data. Based on these maps and hydrogeological conditions in the area, Jhalawar District needs further data to be generated in the gaps even after data of exploration generated during 2018-19 by deployment of departmental DTH Rig . The details of existing data for monitoring and Exploration are given in Annexures I ,II and III, respectively, for the selected NAQUIM areas.

2.3 Geological & Hydrogeological/ Aquifer conditions of the Area:

Geological framework:

Jhalawar is underlain by rocks of Vindhyan super group and Deccan traps. About 60% of the district is covered by Deccan traps (Fig. 3). The Vindhyans comprise of lower and upper Vindhyans represented by Jhalrapatan sandstone, Suket shale and limestone, Kaimur sandstone, Rewa shale, sandstone and conglomerate, Ganugarh shales, lower Bhander sandstone and limestone.

The Vindhyan sandstone and shale form linear hills trending north west to south east. They are exposed around Jhalawar town and to its north east and north west.

These rocks are overlain by twelve basaltic flows between 280 and 481metres mean reduced level. Around Dag and Kolvi, the flows have undergone wide spread laterization. Both fossiliferous and non fossiliferous clay, chert, limestone beds are also present.

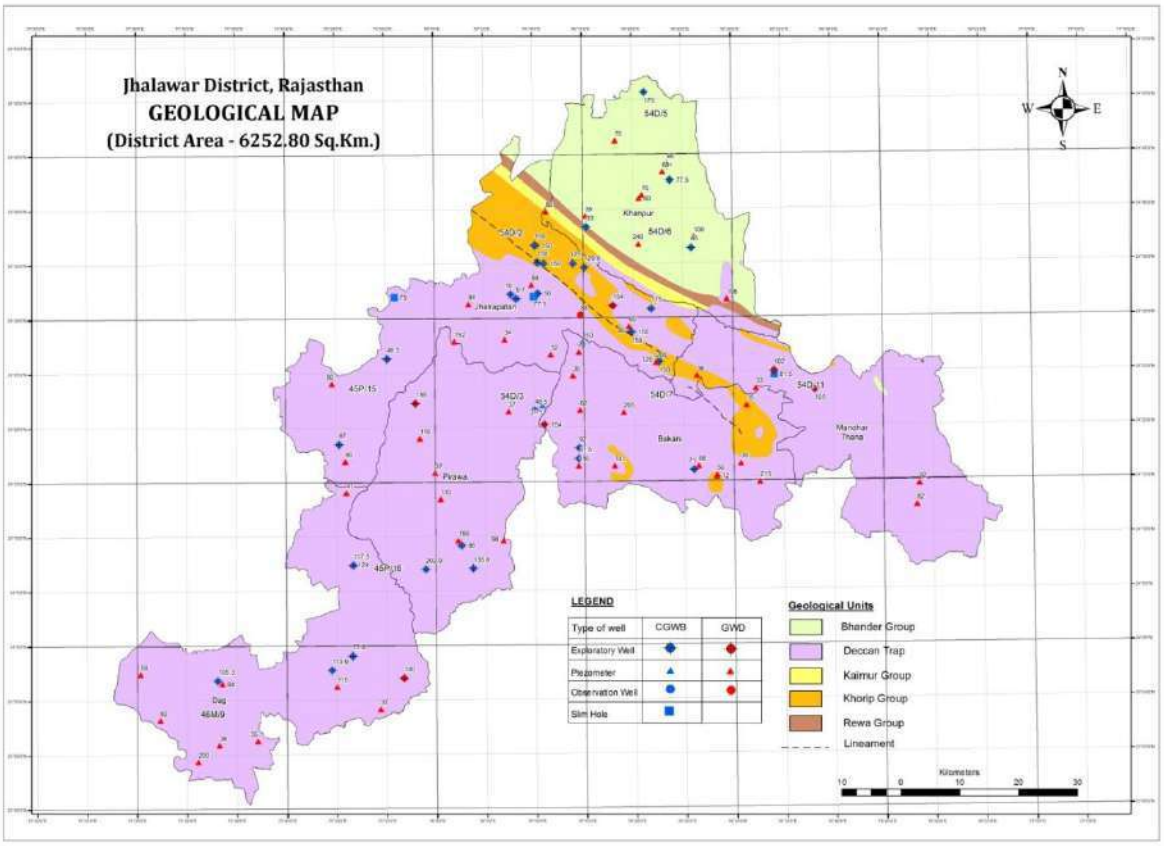


Figure 6: Geology of Jhalawar district.

The entire Dag, Pirawa, Manoharthana and parts of Bakani and Jhalrapatan blocks are occupied by Deccan traps. The northern part of the district comprising of Khanpur block is occupied by sandstone and limestone of lower Bhander group. The main hill ranges comprising of shale, sandstone and conglomerates belong to Rewa and Kaimur groups of upper Vindhyan. Semri group belonging to Lower Vindhyan is exposed in parts of Jhalrapatan block.




Photograph:1 Photographs of the outcrops of different rock types exposed in field area.

Hydrogeology/Aquifer System:

Occurrence of ground water in the district is mainly controlled by the topographic and structural features present in the geological formations. Ground water occurs mainly under unconfined to semi- confined conditions in saturated zone of rock formation. Its occurrence is controlled by topography, physiography and structural features of the geological formations. Movement of ground water in hard rock areas is governed by size, openness, interconnection and continuity of structurally weak planes while in unconsolidated rocks ground water movement takes place through pore spaces between grains. Water bearing properties of different aquifers are described below.

Ground water in Vindhyan Super Group:

Vindhyan sandstones and shales mainly occur in northern part of the district. Sandstones (mostly of Bhander group) are the most widely distributed litho-units in the Vindhyan terrain of the district. Generally the sandstones and shales occur as alternate

layers. The sandstone layers are low dipping, fine grained, compact and hard whereas shales are flaky in nature. Under favourable conditions, the contact of two formations yields water. Within sandstone large dia. open wells are most feasible abstraction structures and yield of wells ranges from 50 to200 cu m/ day. Specific capacity ranges from 20 to 200 litre/min/meter. Ground water within Vindhyan shales occurs under water table conditions in the weathered zone and in fractures formed due to splintery nature of the shales. Large diameter dug wells tapping shales yield only in the range of 20 to 80 cu m/day. Dug wells at a stretch can run for 1 to 2 hours only. Horizontal boring in the dug wells also does not yield promising results.

Ground water in Deccan Traps:

The thickness of basalt ranges from a few meter to more than 200meter. Generally in Dag block, thickness of basalt is more than 200 meter. Ground water in weathered basalt occurs under water table condition. Thickness of weathering in basalt ranges up to a maximum of 20 meter. Large diameter wells are mainly feasible with an average yield of 100 to 120 cubic meters. Ground water in compact basalt occurs under water table condition in the joints and fractures. Yield of open wells ranges from 20 to 200 cubic meter per day. In vesicular basalt, ground water occurs in the vesicles, joints, fissures and cracks. Yield of open wells varies from 40 to 280 cubic meters per day. Vesicular basalts are soft in comparison to compact basalts. In amygdaloidal basalt, ground water occurs in cavities, fissures, cracks and joints. Yield of open wells ranges from a few to 330 cubic meters per day.

Ground water in Alluvium

Alluvial aquifer with limited thickness occurs along river courses like Ahu and Chhoti Kalisindh. Apart from this in some depressions also alluvium of limited thickness forms aquifer. It is comprised of sand, silt and gravel. Along river courses, pebbles are also found. Depth of open wells is maximum upto 18 meters and yield ranges from 100 t o 200 cubic meters per day.

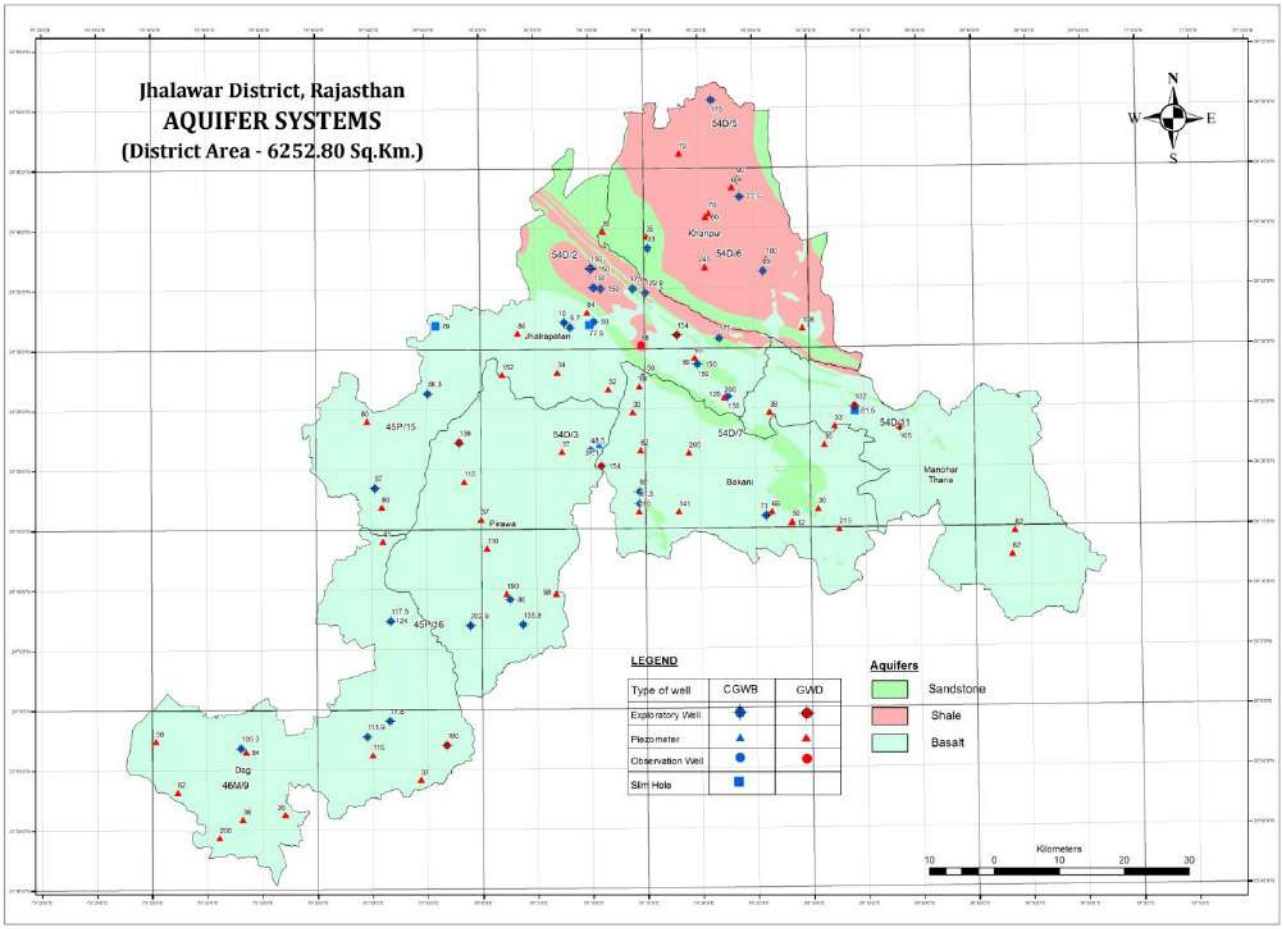


Figure 7: Principal Aquifer Map of Jhalawar district

2.4 Ground Water Exploration before NAQUIM

According to ground water exploration by CGWB, numbers of wells drilled are EW-25, SH-3, PZ-1 upto the depth of 9.7 – 175 (m). The Discharge is at the rate of 30 – 2017 (litre per minute) whereas rate of Transmissivity is 9.3 to 249 (m2/day).

2.5 Ground Water Exploration under NAQUIM

After the detailed studies of aquifers and optimization of data gap analysis, a total no. of 64 bore wells have been established in Jhalawar district under NAQUIM including 10 Pz, 18 OW and 35 EW. The details of the wells along with their aquifer parameters have been given in Annexure I and II. The depth of drilling varies 38.30 m (Manpura) to 202.90 m (Banskhedi) and the discharge of these wells ranges from meager to 1000 lpm.

Photograph:2 Photographs of the Exploratory drilling work, Geophysical VES, aquifer Tests & samples collected while drilling of Vesicular & amygdaloidal besalt in field area.

3. Data interpretation, Integration & Aquifer Mapping: Based on the lithologs of exploratory wells drilled by CGWB and GWD, a lithological, stratigraphical model and fence model has been prepared for Jhalawar district. (figure 8 - 10)

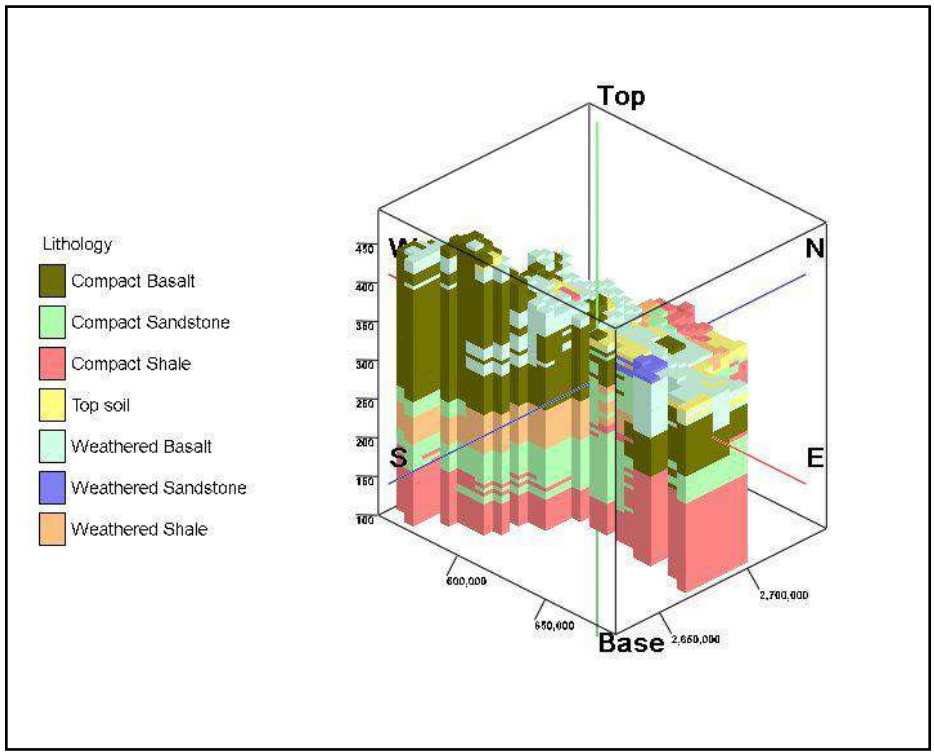


Figure 8: 3-D Lithological Model: In above 3D lithological model, top soil is generally clays whereas other soils are sub classified into weathered and compact.

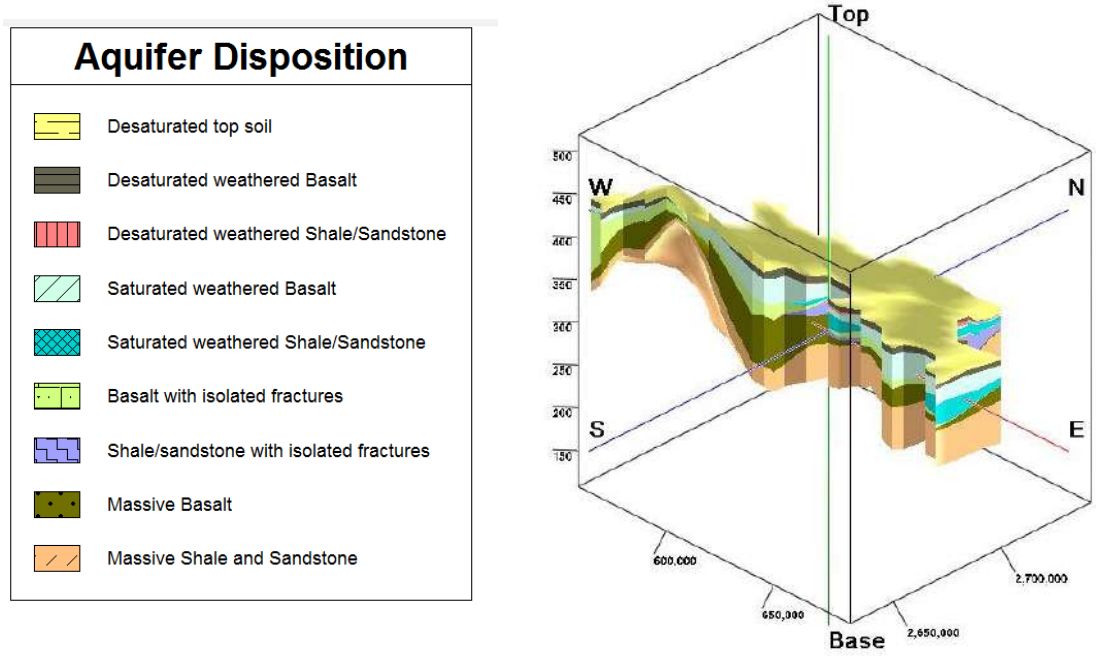


Figure 9: 3-D Aquifer Disposition Model

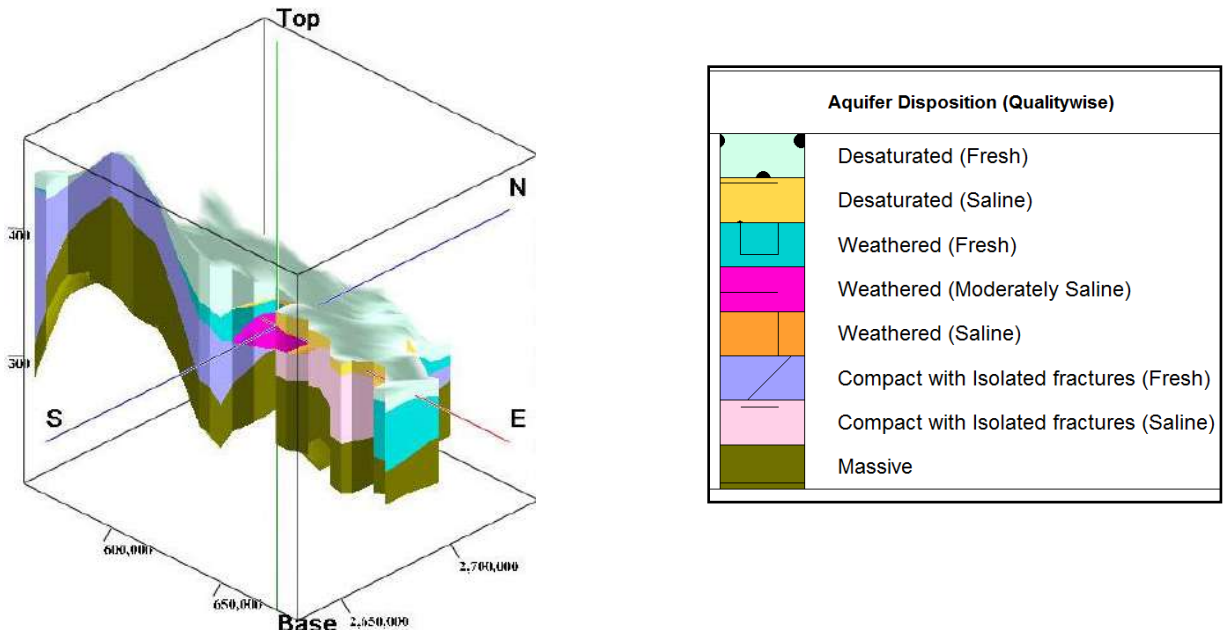


Figure 10: Aquifer dispositions with Quality of Groundwater

The following 3D Fence diagrams, depicting that underground freshwater is decreasing from southwest to northeast direction (fig10.1) whereas underground freshwater is available in the extreme western and eastern in the central part of the district (fig10.2).

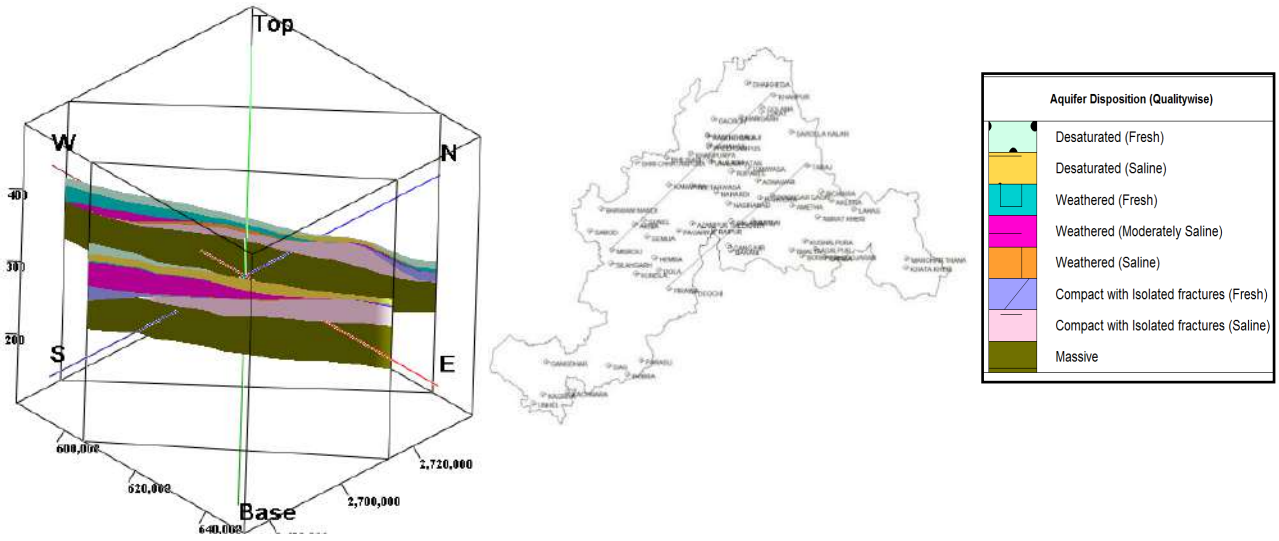


Figure 10.1: 3D Fence diagram depicting quality wise aquifer disposition from southwest to northeast direction

Figure 10.2: 3D Fence diagram depicting quality wise aquifer disposition from west to east direction.

3.1 Groundwater Levels

3.1.1 Depth to Water Level

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. During Pre-monsoon (May, 2018), depth to water level was found to vary from 2 to more than 20m bgl (Figure 11). Water level is shallower in Eastern & southern part of the district. In general, the depth of water level increases from south to north. Water level in the range of 5 to 10 m bgl was observed in major part of Jhalrapatan and small areas in Dag, Pirawa and Manohar Thana blocks. The deeper water level in the range of more than 20 m bgl was observed in isolated pocket in Pirawa, Khanpur & J.Patan blocks.

During Post-monsoon (November, 2018), depth to water level in major part of the district was observed to be between 2 and 10 m bgl (Figure 12). The deeper water level in the range of 10 to 20 m bgl was observed in isolated pocket in Pirawa, Khanpur & J.Patan blocks..

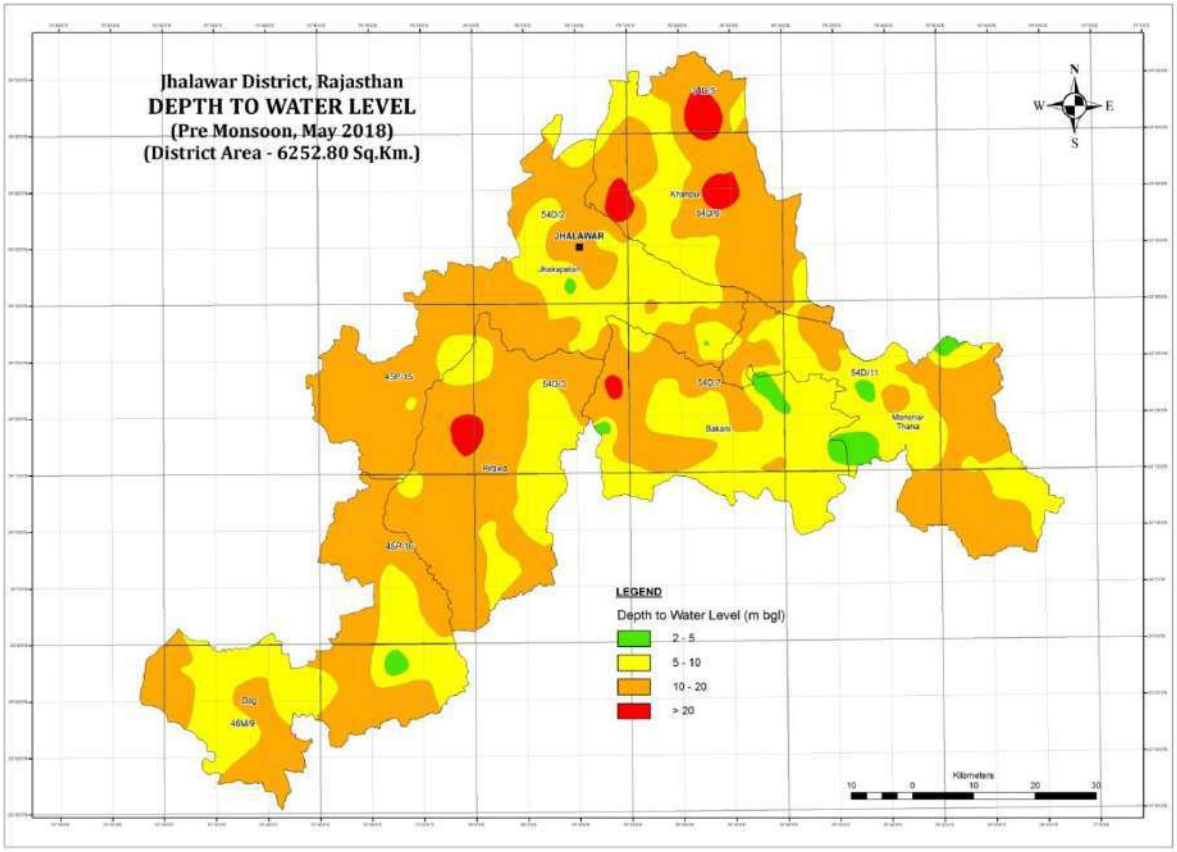


Figure 11: Depth to Water Level (Pre Monsoon - May 2018)

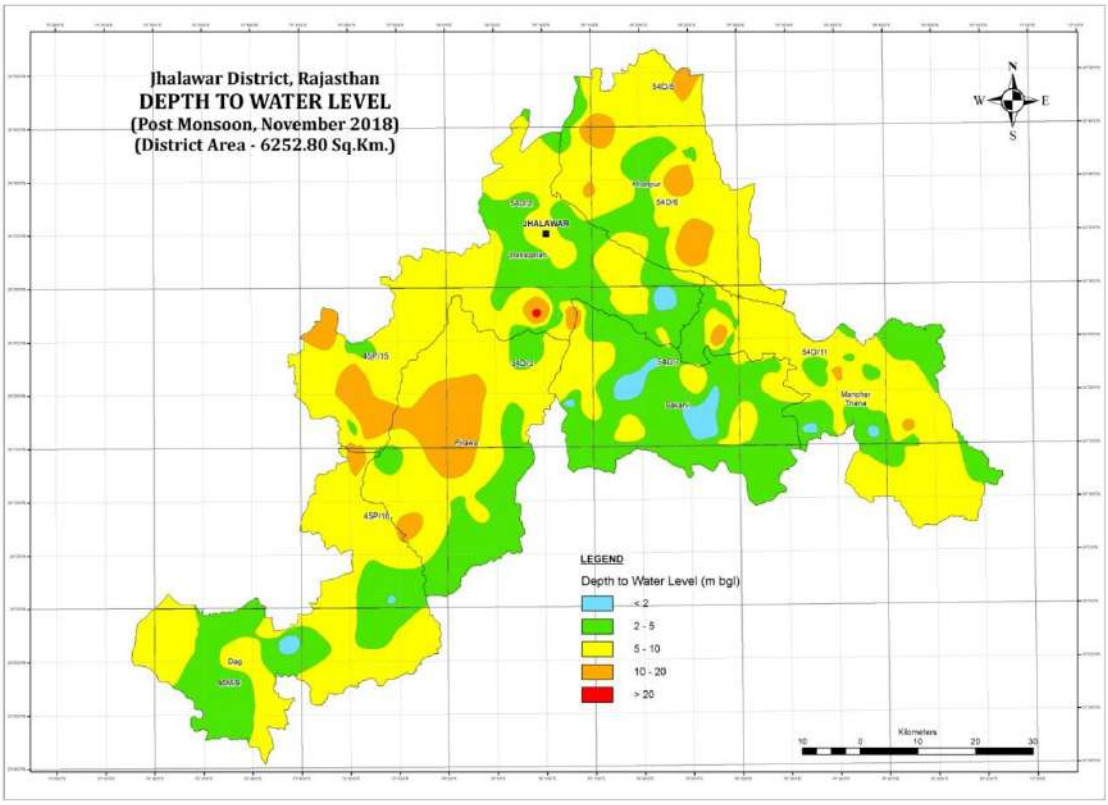


Figure 12: Depth to Water Level (Post Monsoon - November, 2018)

3.1.2 Long Term Fluctuation

Analysis of water level data of Pre and Post-monsoon 2017 indicates that there has been rise in water level in major part of the district (Figure 13). A perusal of water level fluctuation data indicates that major part of the district has recorded rise in water level of more than 4m.

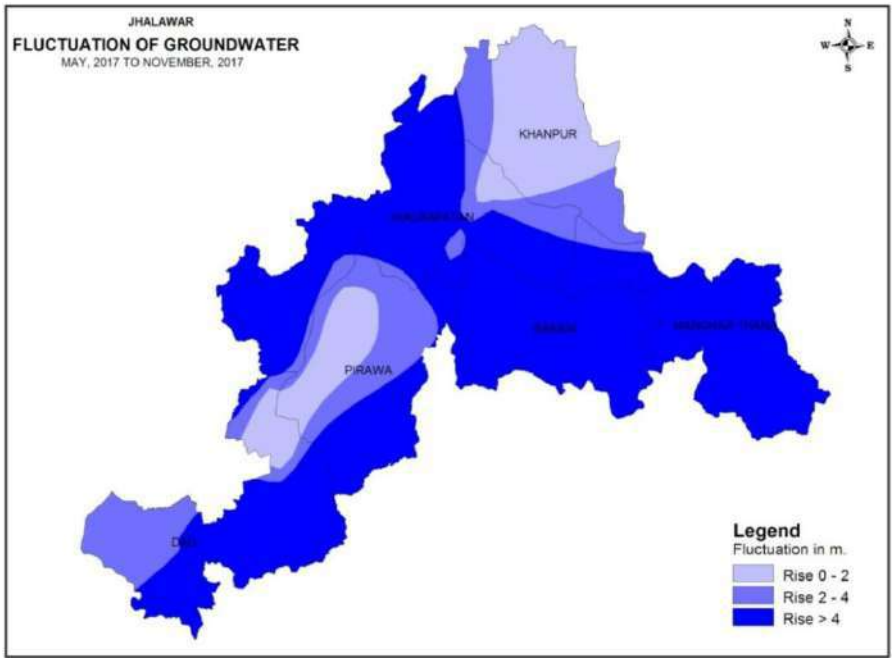


Figure 13: Seasonal fluctuation of Water Level (May – Nov 2017)

Analysis of long term water level data of Pre-monsoon (May, 2017 to Nov, 2017) indicates rising trend of upto 25 cm/ year in ground water levels in major part of the district except parts of Jhalrapatan, Khanpur, Pirawa, Manohar Thana and Bakani blocks, where declining trend of upto 25 cm/ year in water levels has been recorded (Figure 13).

The following decadal water level trend map shows majorly rise in the water level of district upto 4 meter except at few places where fall is more than 4 meter.

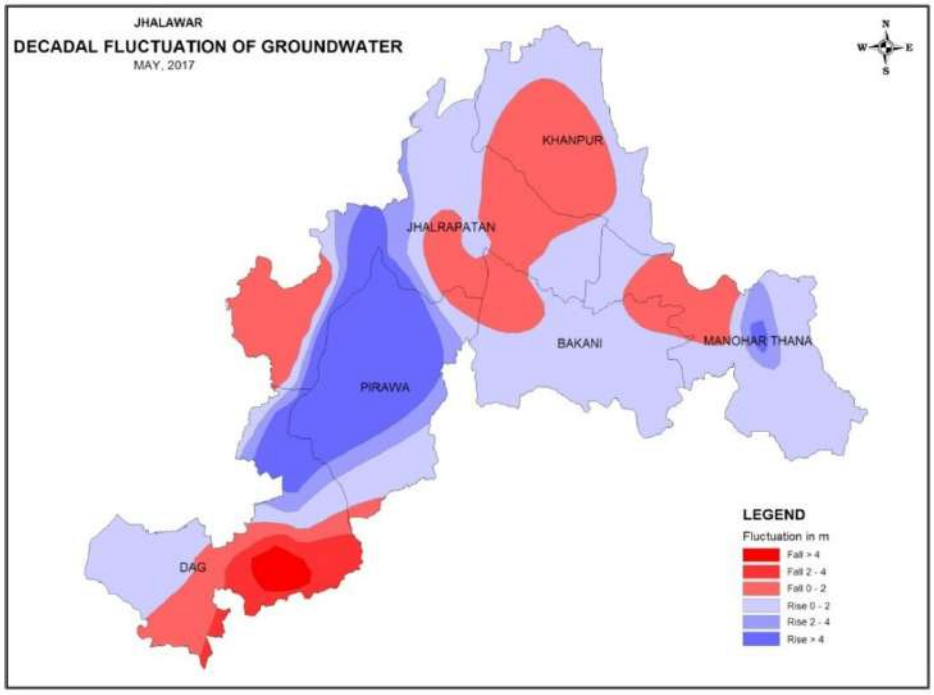


Figure 14: Decadal water level trend (May 2017)

The long term Hydrographs for selected stations have been presented below. In the following block wise hydrographs, the post monsoon water level is higher than the pre monsoon water level. Since 2007, the annual rainfall in all the blocks has been increased except in the dag block.

Similarly in the hydrograph of whole district the post monsoon water level is higher than the pre monsoon water level. The probable reasons of such results are:

- Increase in rainfall except Dag block where 2800 mm was recorded in 2007 which has been decreased to 1400mm in 2016 year.
- The rate of recharge has also been increased as in 2004 it was 430.82 mcm and in 2013 it becomes 546.8 mcm.

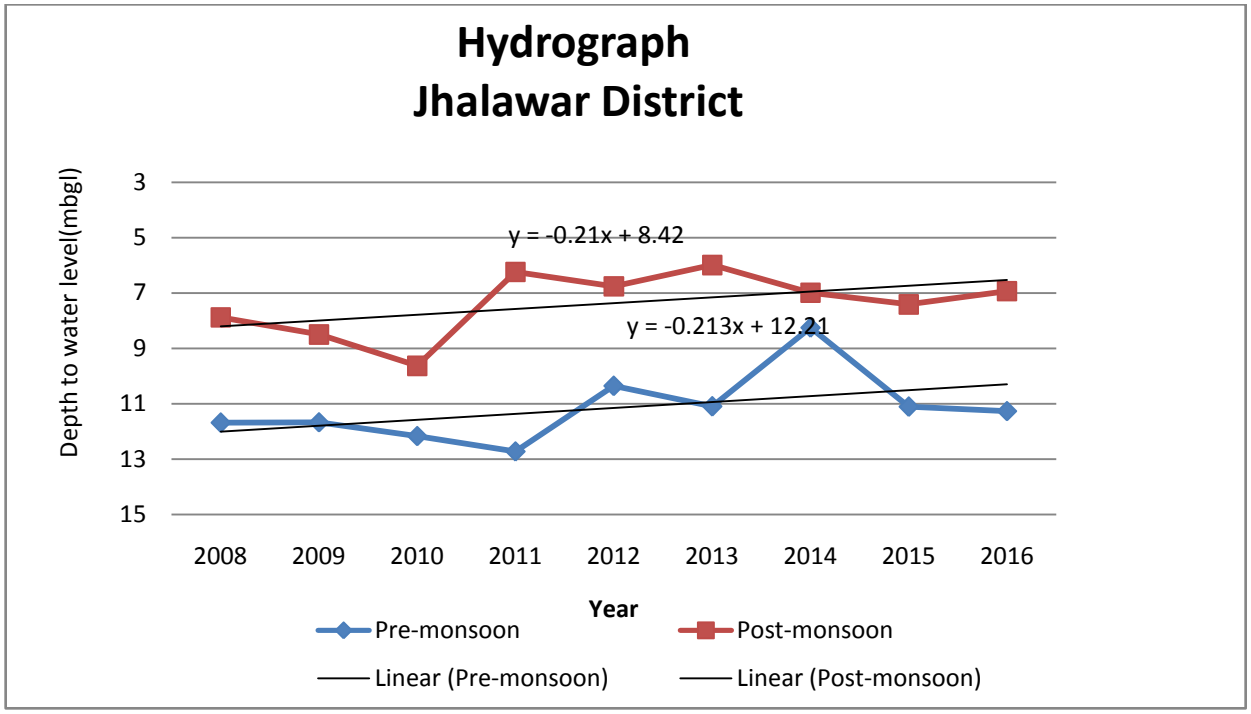
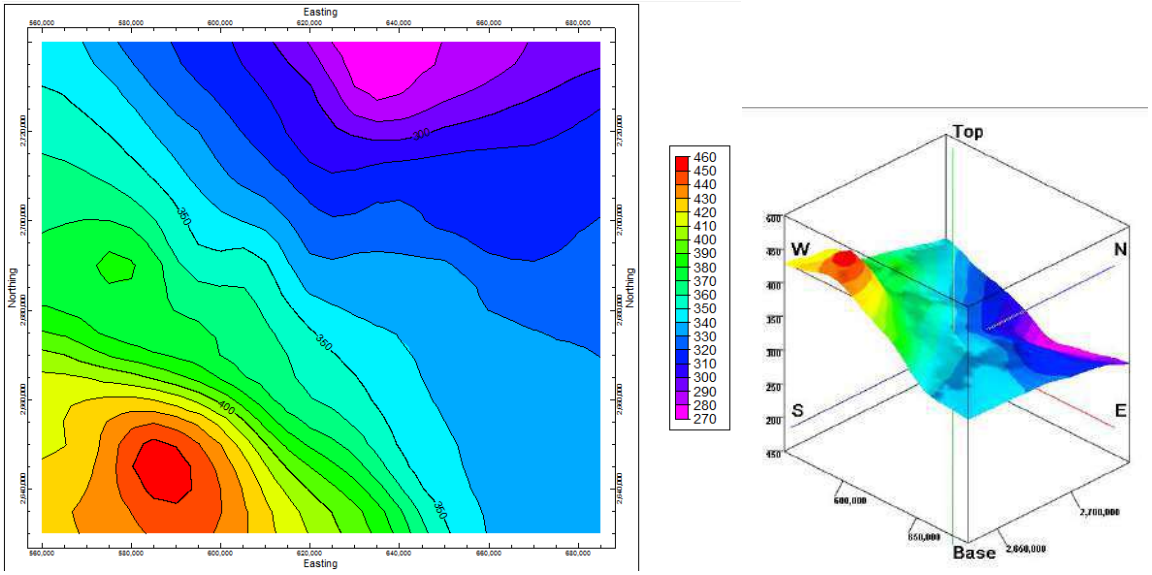


Fig. 15 Hydrograph of Jhalawar district.

3.1.3 Elevation of Water Table

Based on the available data, the water table elevation map has been generated and shown in figure 16. As per map, the elevation of water table in the area ranges between 280 to 460 m amsl. The highest elevation of water table of nearly 460 m amsl is in the south western part of the district while the lowest elevation of 280 m amsl has been observed in the north eastern part of district.



Water table elevation 280 to 460 meter above mean sea level

Figure 16: Water Table Elevations

4: Groundwater Quality:

General ground water quality:

On analysis of ground water samples collected from Jhalawar district during pre and post monsoon 2018, it is observed that, in general, the water is of fresh to high salinity with one exception of high salinity observed in sample collected from well located at Bhilwari. Salinity, determined as Specific conductance is depicted in Figure 17(a&b). Ground water in most areas of the district is of medium salinity with an isolated pocket of highly saline water in North-western region. The point values of Fluoride Figure 18 (a&b) do not indicate a fixed pattern while the point values of Nitrate Figure 19(a&b) show higher concentration in south-western part of the district. No fixed pattern of Iron concentration is observed in groundwater Figure 20(a&b) both pre and post monsoon.

The hydrochemical-facies determined by Piper diagram Figure 21(a&b) indicates that Ca+Mg are the predominant cations, followed by Na in few isolated places. HCO_3 followed by Cl is the predominant anion at most places. The ground water, in the district, is primarily Ca+Mg-HCO_3 or mixed type indicative of temporary hardness.

Well water of Bhilwari is unsuitable for drinking purposes as it is highly saline and sodic with high Chloride, sulphate, total hardness, calcium, magnesium and sodium concentrations. Fluoride above 1.5mg/l (BIS drinking water limit) is found at few isolated places while Nitrate above 45 mg/l is observed in many samples, indicating anthropogenic contamination due to sewage, manure, etc.

To ascertain the suitability of groundwater for irrigational use, USSL diagrams Figure 22 (a&b) was plotted for samples analysed, both pre and post monsoon. Samples falling in C2S1and C3S1 classes have medium to high salinity and low sodicity. This water can be used for irrigation in well drained soils. Waters falling in C3S3, C4S3 and C4S4 classes are of high to very high salinity and high sodicity that may lead to salinity as well as sodium hazards when used for irrigation under normal practices. Such waters may be used after blending or addition of suitable soil amendments.

Temporal variation in ground water quality Pre and Post monsoon 2018

The temporal changes in ground water quality are studied by considering important parameters such as salinity (EC), chloride, nitrate and fluoride contents of waters. The percent well waters falling in desirable, permissible and unsuitable classes of BIS-2012 standards during pre-monsoon are compared with percent well waters in same classes during post monsoon. Table- 3 shows increase or decrease of percent well water falling in various suitability classes for drinking purposes.

Table 3: Periodic Variation in Suitability Classes of Well Waters of Jhalawar District

Parameter	Class	% of Samples		Periodic Variation
		Pre-monsoon (n= 39)	Post-monsoon (n=43)	
Salinity as EC (in µS/cm at 25^0C)	<750	15	16.3	+1.3
	750-3000	77.3	79.1	+1.8
	>3000	7.7	4.6	-3.1
Chloride as Cl (in mg/l)	<250	77	81.4	+4.4
	250 - 1000	17.9	16.3	-1.6
	>1000	5.1	2.3	-2.8
Nitrate as NO_3 (in mg/l)	< 45	56.4	32.6	-23.8
	> 45	43.6	67.4	+23.8
Fluoride as F (in mg/l)	<1.0	87.2	79.1	-8.1
	1.0 - 1.50	10.3	16.3	+6.0
	>1.50	2.5	4.6	+2.1

n=number of samples

There is an improvement in water quality with respect to salinity by 3.1% of samples with specific conductance less than 3000 µmhos/cm. This variation is also visible on comparing Plate 1&2 which clearly depicts increase in area falling in lower salinity ranges. Similarly, the percent of samples having chloride less than 250mg/l has increased by 4.4% depicting its slight dilution. There is considerable increase in % of groundwater samples with nitrate >45mg/l post monsoon(23.8%). The increase in nitrate concentration is more discernible in south-western and southern parts of the district. This may be due to percolation of nitrates from sewage or manure present topsoil.

A slight change in type of water, in post-monsoon samples is observed, with a marginal increase in samples having mixed type character, wherein, no particular ion is dominant. This may be due continuous process of base-exchange reactions taking place in the aquifer.

The comparison of USSL diagram Figure 22 (a&b) also indicates a decrease in samples falling in C3S3,C4S3 & C4S4 class due to decrease in salinity and sodicity in groundwater post monsoon.

In general, a slight improvement in water quality post monsoon is observed as concentration of almost all parameters decreasing with exception of nitrate, fluoride, sodium and potassium at isolated locations.

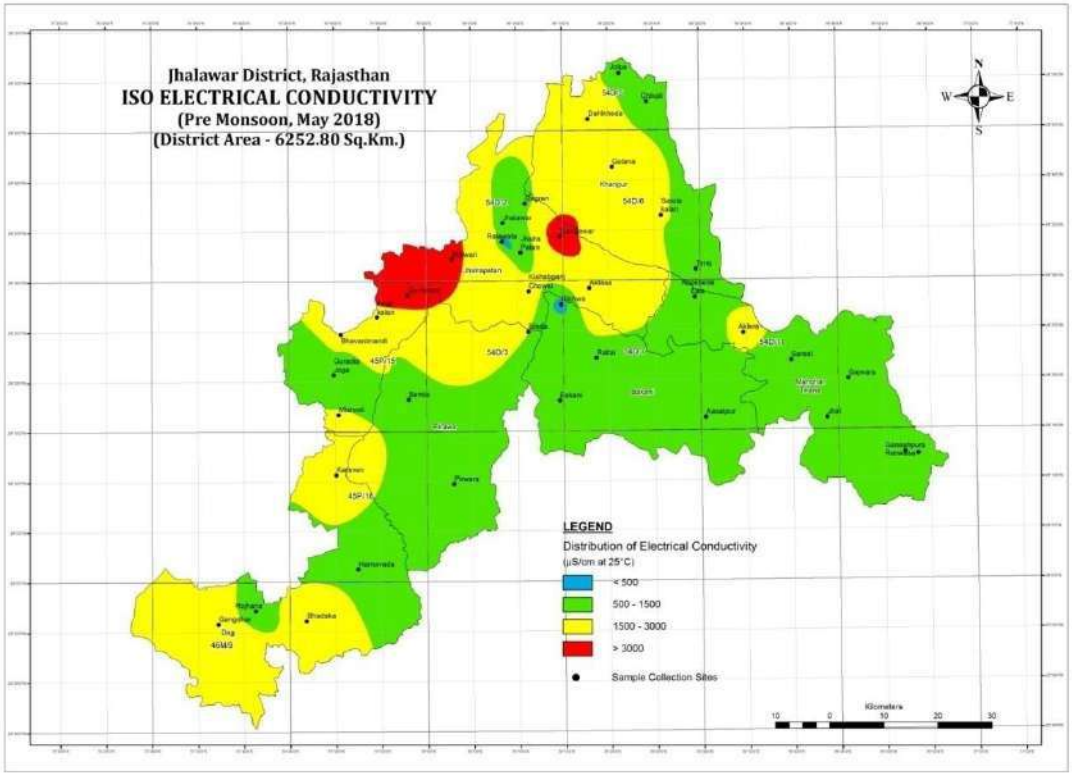


Figure 17(a): Iso Electrical Conductivity (May 2018)

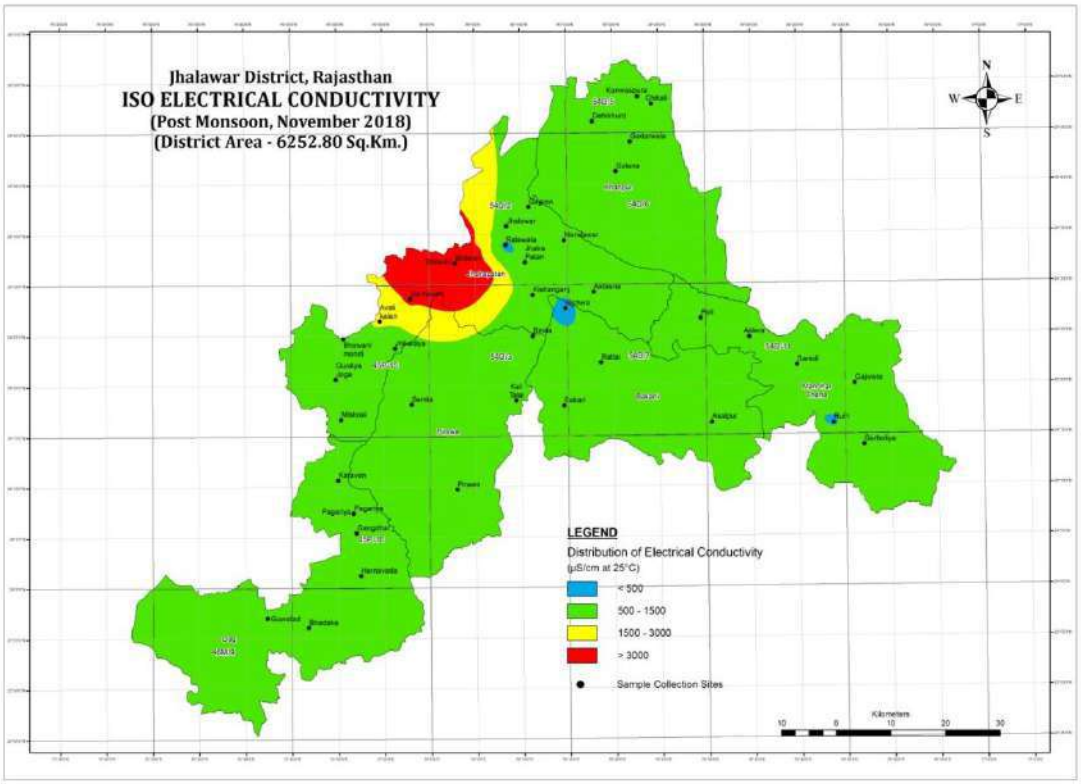


Figure 17(b): Iso Electrical Conductivity (November 2018)

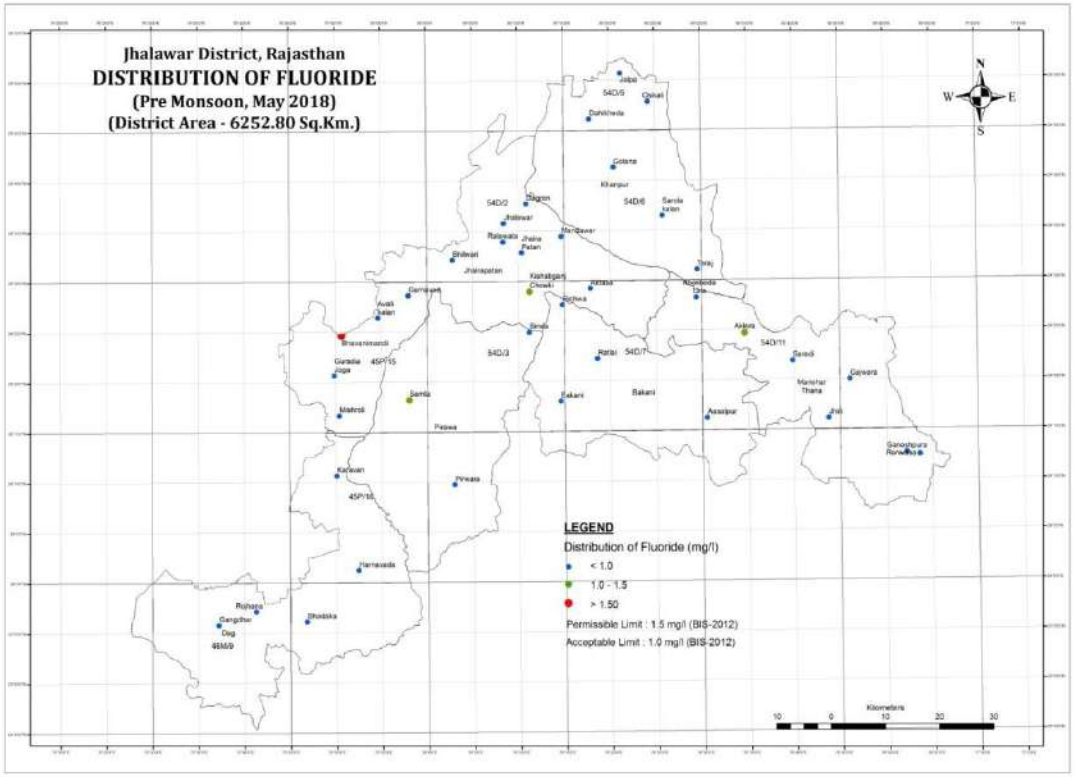


Figure18(a): Iso Fluoride (May 2018)

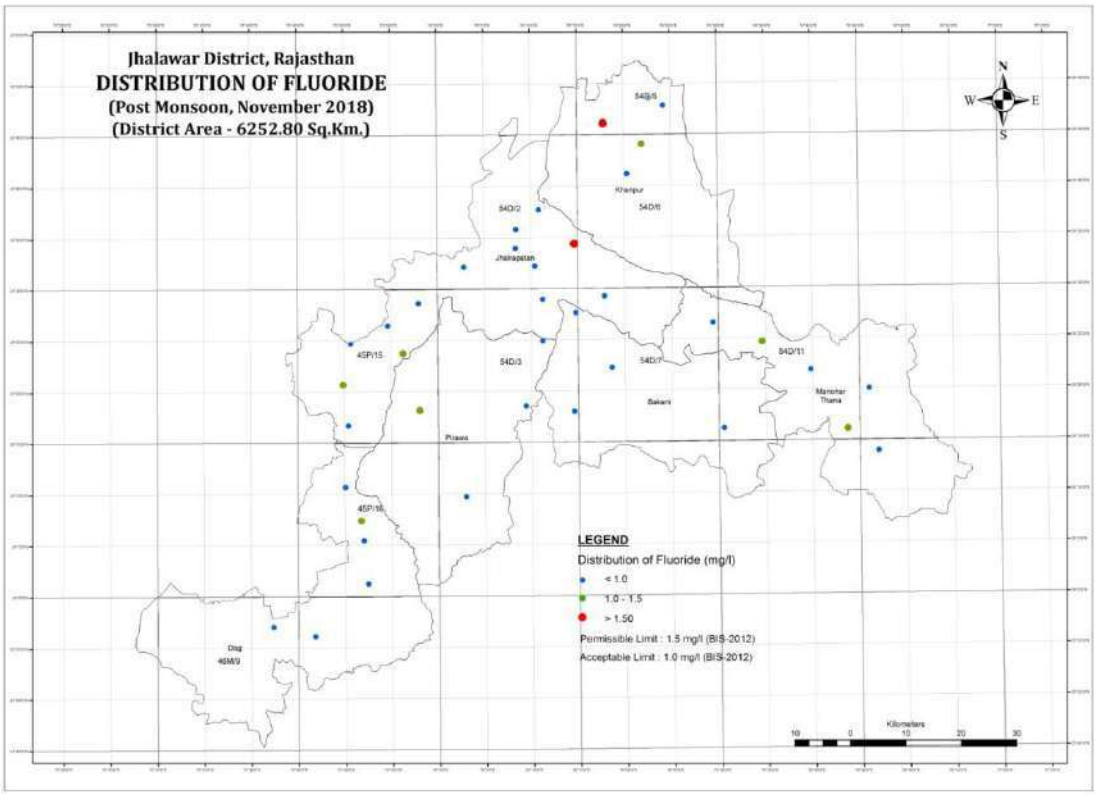


Figure18(b): Iso Fluoride (November 2018)

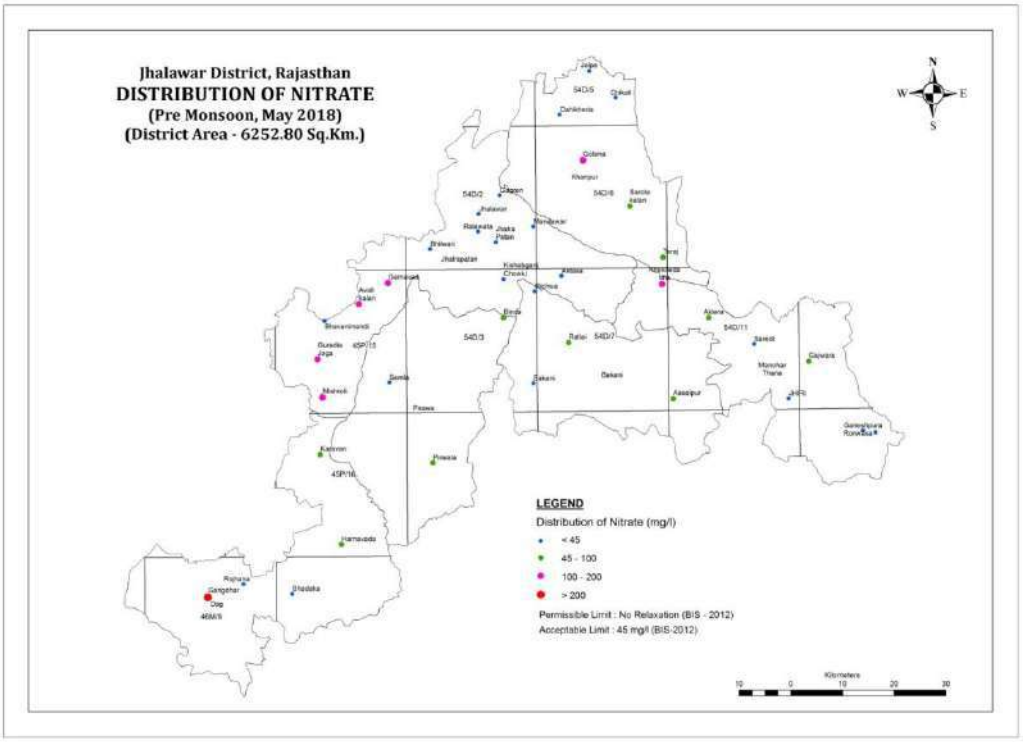


Figure 19(a): Nitrate Distribution (May 2018)

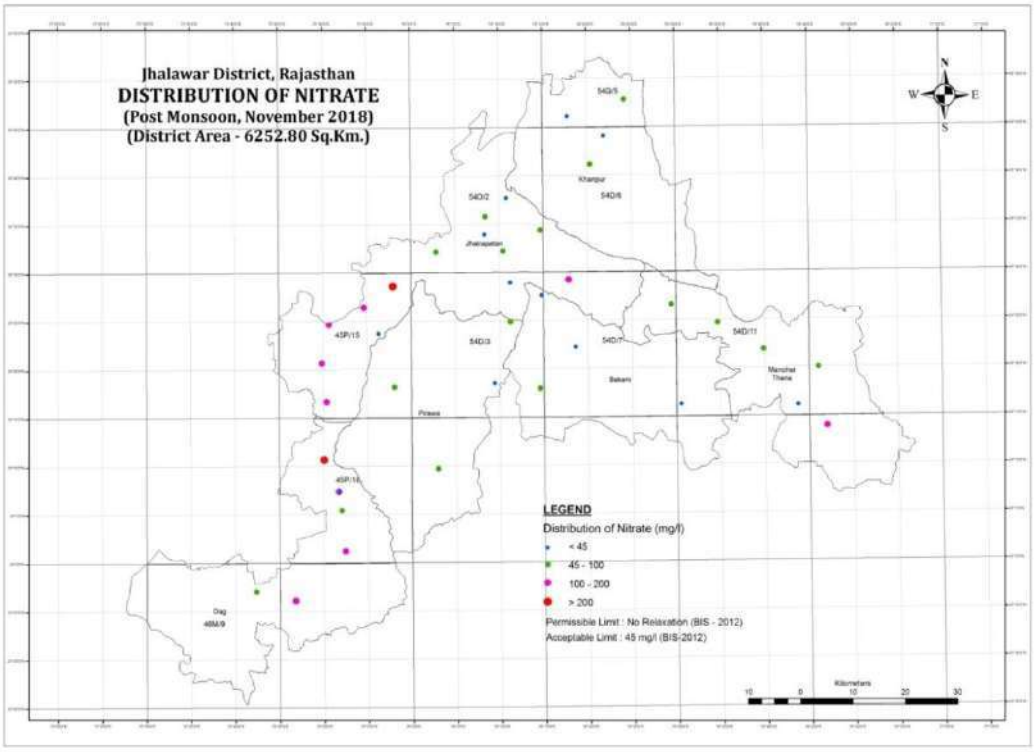


Figure 19(b): Nitrate Distribution (November 2018)

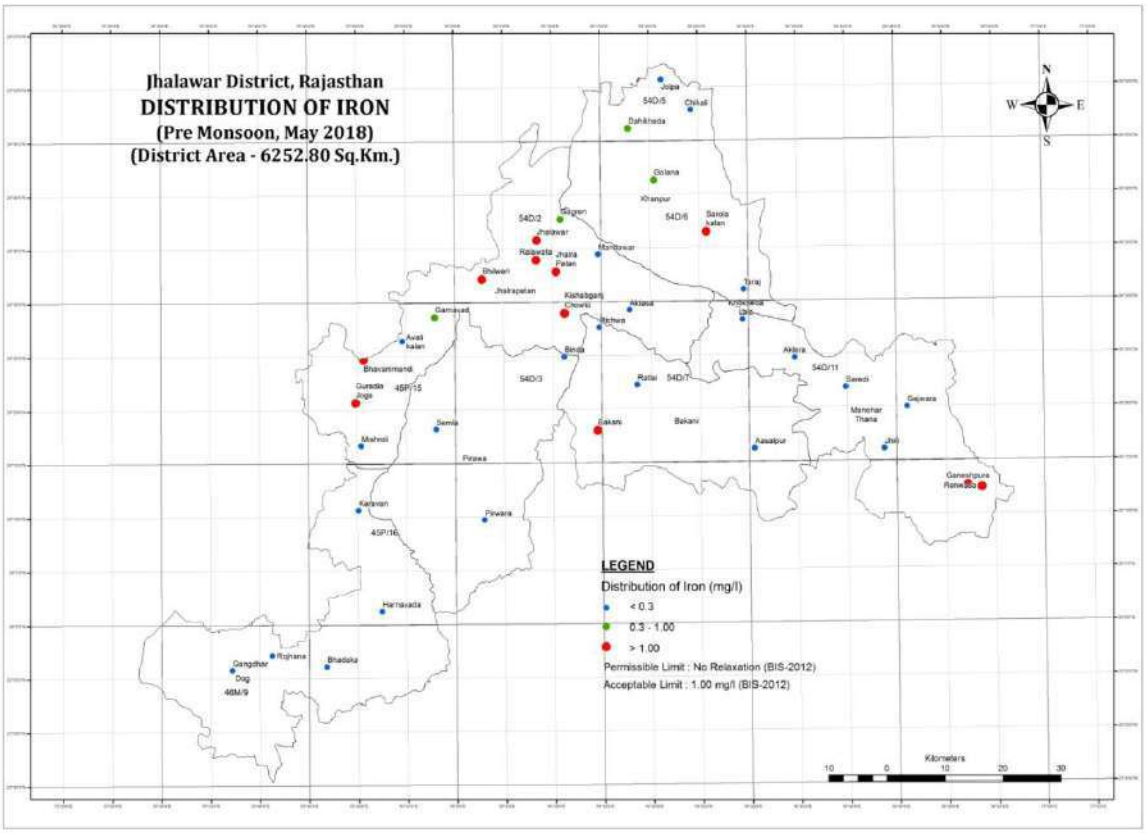


Figure 20(a): Iso Iron (May, 2018)

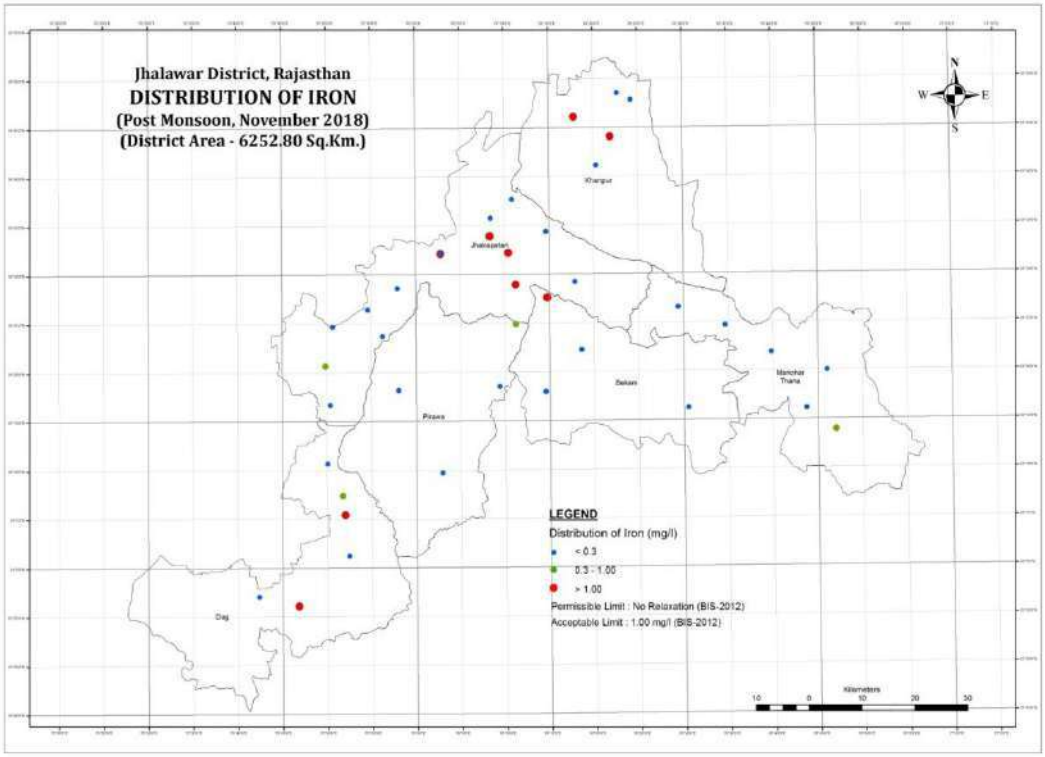


Figure 20(b): Iso Iron (November, 2018)

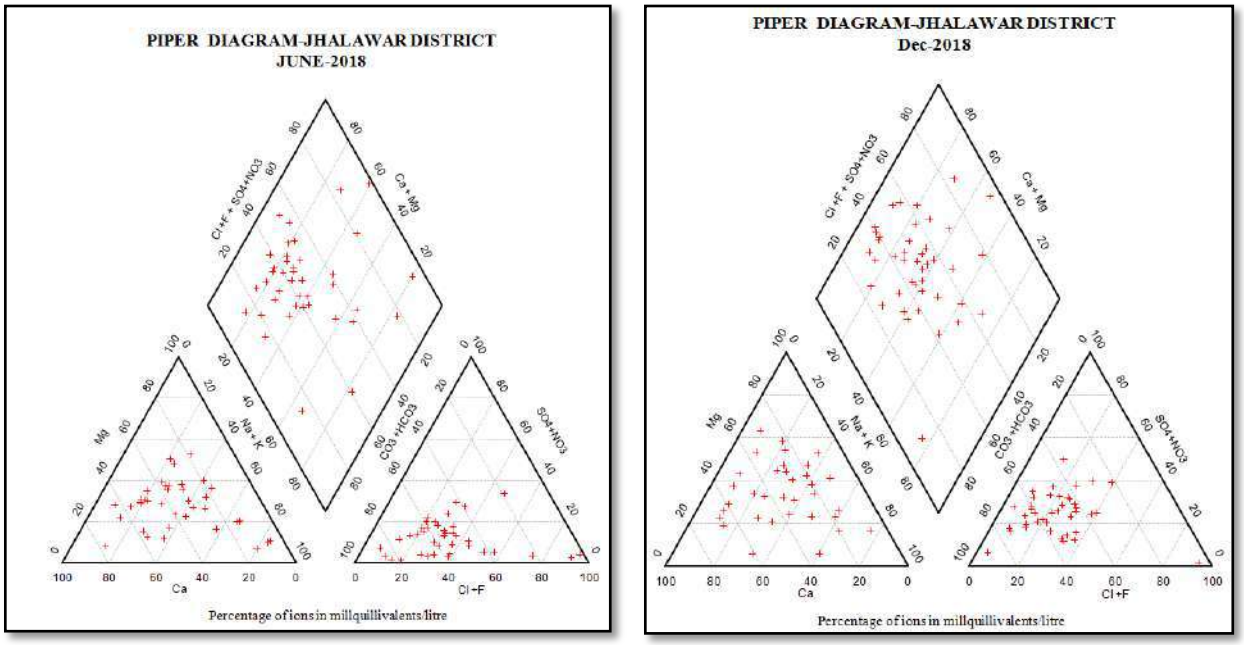


Figure 21(a&b) : Showing Piper diagram for Pre & Post monsoon period.

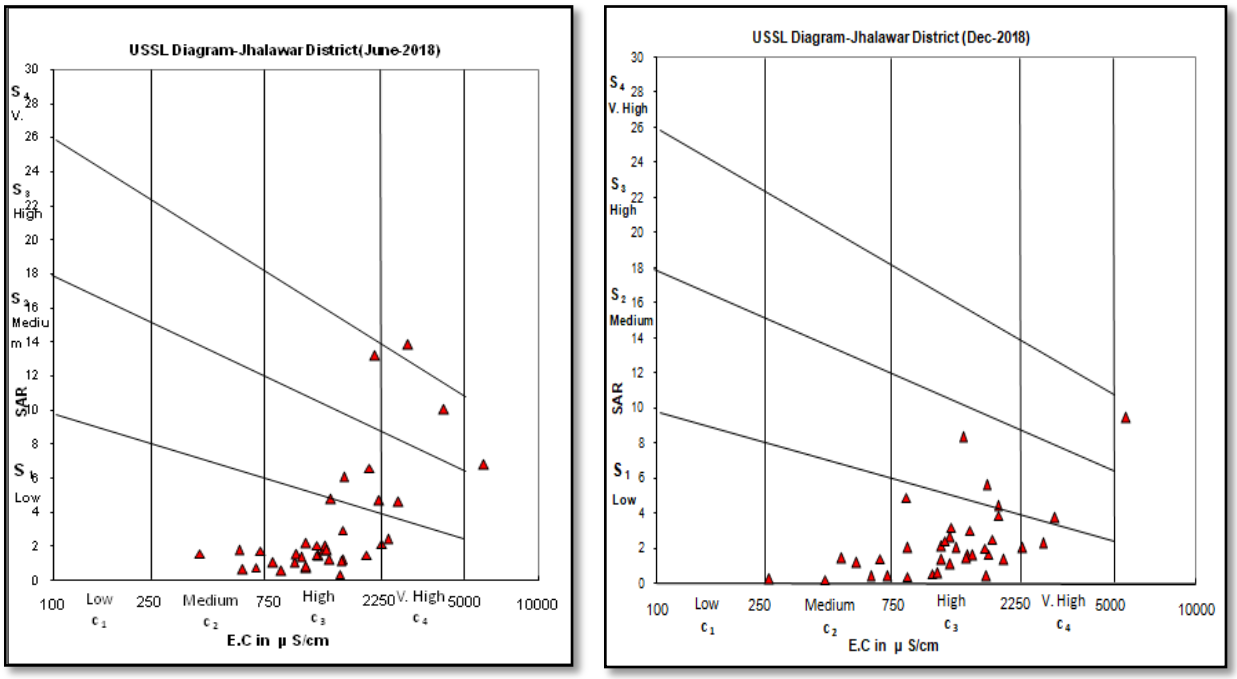


Figure 22(a&b) : Showing USSL diagram for Pre & Post monsoon period.

5. Groundwater Resources

The Groundwater resources have been reassessed as on 31.3.2013 based on the methodology recommended by Groundwater Estimation Committee (1997). The block wise resources for Jhalawar district are given in Table 3. All the blocks of Jhalawar district fall in critical category.

Groundwater resource estimation data of Jhalawar district shows that net groundwater availability of the district is 546.8067 MCM whereas ground water draft for all uses is 539.3901 MCM. Due to this, the stage of groundwater development has reached to 98.64.

Table 4 Groundwater resource, Draft and stage of development (as on 31.03.2013)

Block	Area of Block (Sq.km.)	Potential zone area (Sq.km.)	Total Annual Groundwater Recharge (MCM)	Natural Discharge during Non-Monsoon season (MCM)	Net Annual Groundwater Availability (MCM)	Existing Gross Ground Water Draft for Irrigation (MCM)	Existing Gross G.W. Draft for Dom. & Ind. Use (MCM)	Existing Gross Ground Water Draft for all uses (MCM)	Stage of G.W. Development (%)	Category
Bakani	881.52	865.98	104.4094	19.1581	85.2513	81.4447	2.2702	83.7149	98.20	Critical
Dag	1132.87	1087.09	93.1078	9.3108	83.7970	70.3620	4.2469	74.6089	89.04	Semicritical
Jhalrapatan	1341.31	1299.62	118.2272	11.8227	106.4045	101.1132	3.4366	104.5498	98.26	Critical
Khanpur	949.70	932.90	111.3607	28.3302	83.0305	88.2351	2.7925	91.0276	109.63	Over Explo.
Manohar Thana	937.46	919.97	111.3310	21.4546	89.8764	84.8130	2.3691	87.1821	97.00	Critical
Pirawa	1009.94	1000.60	126.3443	27.8973	98.4470	95.8512	2.4556	98.3068	99.86	Critical
District	6252.80	6106.16	664.7804	117.9737	546.8067	521.8192	17.5709	539.3901	98.64	Critical

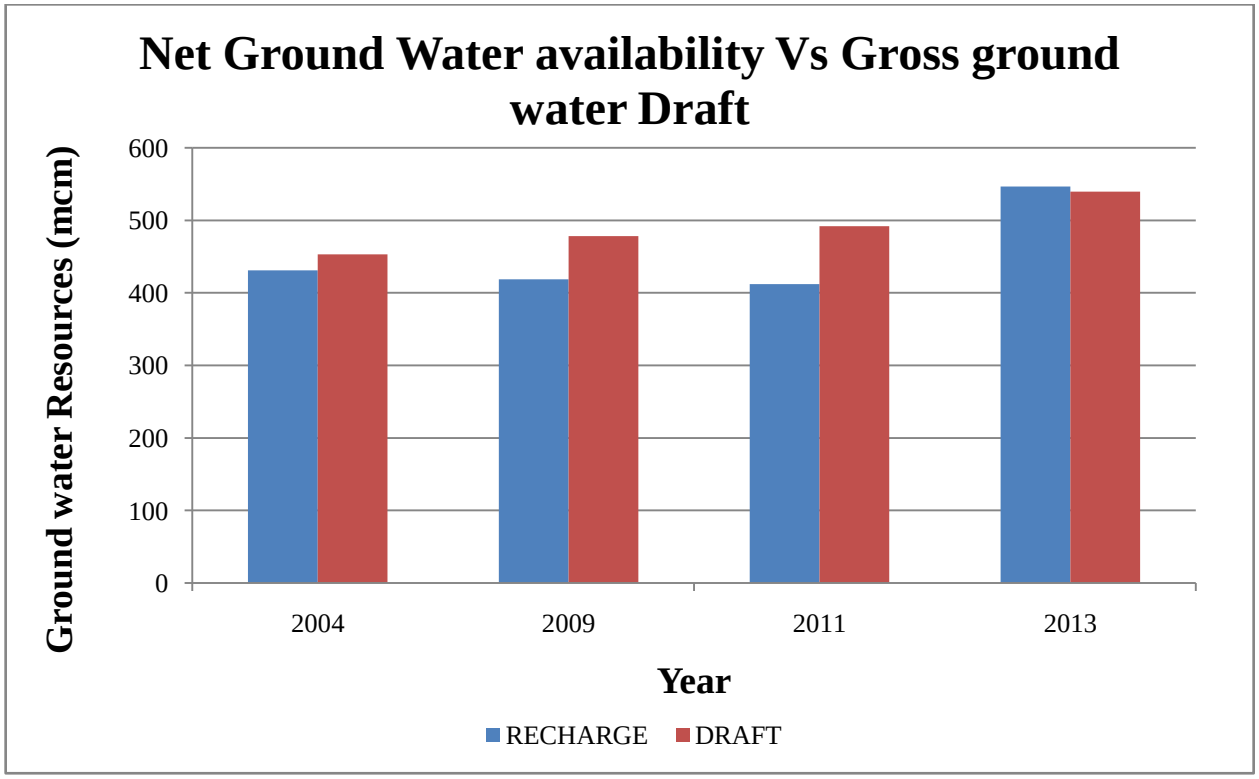


Fig 23: Showing graph of net G.W.availability Vs gross G.W.draft.

5.1 Groundwater Recharge

The total groundwater recharge during monsoon and non monsoon season through rainfall and other sources in Jhalawar district is 664.7804 MCM. Considering the natural discharges of 117.9737 MCM, the Net groundwater Availability comes out to the value of 546.8067 MCM

5.2 Groundwater Abstraction

The groundwater development in the district is being done through dug wells, bore wells and dug cum bore wells. Dug wells with horizontal boring are very common. The diameter of dug well varies from 3 m to 5 m. The depth and diameter of the dug wells and tube wells depend on formation and geomorphology. However, general depth of dug wells ranges from 25 to 30 m and bore wells between 80 to 100 m in alluvium & 65 to 200 m in hard rocks. The present stage of ground water development in the district is 98.64%, which indicates that the scope of groundwater development is very less.

6. **Public interaction programme in NAQUIM field area of Jhalawar district, Rajasthan.**

The interaction held with the trainees from different fields in PNB campus at Jhalrapatan, field area, including meetings at different village Panchayats in parts of jhalawar district under Public interaction programme in NAQUIM field area of Jhalawar district, Rajasthan. The self explanatory photo pics are attached herewith.

इंजीनियरों की दो दिवसीय प्रशिक्षण कार्यशाला आयोजित

आईटीसी मिशन सुनहरा कल और आईआईआरडी की ओर से सीएसआर मद में किए जाने वाले जल संरक्षण कार्यों के लिए स्वयंसेवी संस्थाओं के इंजीनियरों के लिए दो दिवसीय प्रशिक्षण एवं कार्यशाला का आयोजन कृषक प्रशिक्षण केंद्र पंजाब नेशनल बैंक में किया गया।

कार्यक्रम में वाटर शेड विभाग के एसई जीतमल नागर ने वाटर बजटिंग के बारे में जानकारी दी। जलग्रहण विकास परियोजनाओं को बनाते समय कृषि एवं पीने के पानी की आवश्यकता को देखते हुए जल संरक्षण ढांचों की मात्रा भराव क्षमता को ध्यान में रखा जाता है। केंद्रीय भूजल विभाग के वैज्ञानिक एस एस सारस्वत ने जल संरक्षण कार्यों से भूजल को रिचार्ज करने एवं रिचार्ज के प्रभाव जानने के तरीके बताए।

झालावाड़ जिले में पानी का जलस्तर प्रतिवर्ष 1 मीटर नीचे जा रहा है जिसे समय रहते नहीं रोका गया तो भविष्य में पीने का पानी भी नहीं मिलेगा। इस मौके पर मुनेश सक्सेना, भवानीशंकर मीणा, मनोज कुमार मिश्रा, सुपति चिंचकर सहित अन्य ने विचार व्यक्त किए। पीएन अग्रवाल सहित अन्य मौजूद रहे।

Training programme of ITC at Jhalrapatan	Artificial Recharge structure, Prithwipura.

Panchayat bhavan, Ratlai village Block: Pirawa

Gangdhar village surpunch & member

Panchayat bhavan, Pagariya village. Block : Dag.

Photographs-3: Photographs of the public interactions in different parts of the district.

The ground water issues of exploration difficulties, depleting water levels, quality, artificial recharge structures etc. and their available remedies were discussed at length with peoples and village panchayat level and engineers, social workers, NGO's working in jhalawar district of Rajasthan.

7. Groundwater Related Issues & Problems

7.1 Limited Subsuface-storage Space

It has been found out that there is insufficient space is available for storage of groundwater (fig-24). As the thickness of suitable weathered area is less therefore the possibility to recharge groundwater is also very less.

7.2 Shallow Water Level

In the most of the parts of the district, the post monsoon water level has raised than its pre monsoon water level. Due to which water logged conditions and floods usually occurs during the monsoon at some parts of the district.

7.3 Quality Hazard

Excess concentrations of Fluoride, Nitrate and Iron in ground water have been reported from some places in the district.

7.4 Water Scarcity during the Rabi Cultivation

The problem of water scarcity during the cultivation of Rabi crops is very serious in the district. Despite of having post monsoon water level more than the pre monsoon water level the water scarce condition occurs which creates problem in irrigation. It happens due to less sub-storage space and shallow water level for groundwater recharge which often results into floods in some parts of the district during the monsoon.

7.5 Presence of silicious sandstone

The silica containing sandstone in hard rocks reduces the seepage of rainwater and thus reduces the possibility of groundwater recharge.

7.6 Difficulties in drilling and construction of borewells

The difficulties observed in drilling and construction of borewells in deccan traps specially penetrating different flows and intertrappeans (Red & Green balls formation).

8. Management Plan

Part A

Management Plans of district Jhalawar

In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management.

8.1Supply Side Management

The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. The de-saturated volume of aquifer for the Jhalawar district is computed based on following; the area feasible for recharge, unsaturated depth more than 6 m bgl and the specific yield of the aquifer. The block-wise volume available for the recharge is given below in table 5.

Table 5: Area Feasible and Volume Available for Artificial Recharge

Block	Area of Block (Sq.km.)	Potential area suitable for recharge (Sq.km.)	Type of Aquifer	Area feasible for artificial recharge (Sq km)	Sp Yield	Average DTW (mbgl) NOV 2013	Thickness of unsaturated zone 3 m below ground level (m)	Volume of sub surface storage space available for artificial recharge (5*6*8) (MCM)
1	2	3	4	5	6	7	8	9
Bakani	881.52	865.98	Hard rock	865.98	0.020	5.51	2.51	43.47
Dag	1132.87	1087.09	Hard rock	1087.09	0.015	7.66	4.66	75.99
Jhalrapatan	1341.31	1299.62	Hard rock	1299.62	0.020	7.55	4.55	118.27
Khanpur	949.70	932.9	Hard rock	932.90	0.015	11.28	8.28	115.87
Manoharthana	937.46	919.97	Hard rock	919.97	0.015	7.26	4.26	58.79
Pirawa	1009.94	1000.6	Hard rock	1000.60	0.015	7.8	4.80	72.04

It can be seen that surplus water is available in sufficient amount for artificial recharge in this district. The total de-saturated area available is 945.80 sq km and water required to recharge this de-saturated area will be 1418.71 mcm which is easily available from surplus water available from rainfall i.e. 1734.03 mcm if 30% runoff coefficient is considered.

To prevent the flood conditions, the adequate surplus surface water can be used to recharge the underground water at suitable sites which can be determined with the help of below contour maps, former showing total thickness of weathered area, latter showing post monsoon underground water level depth.

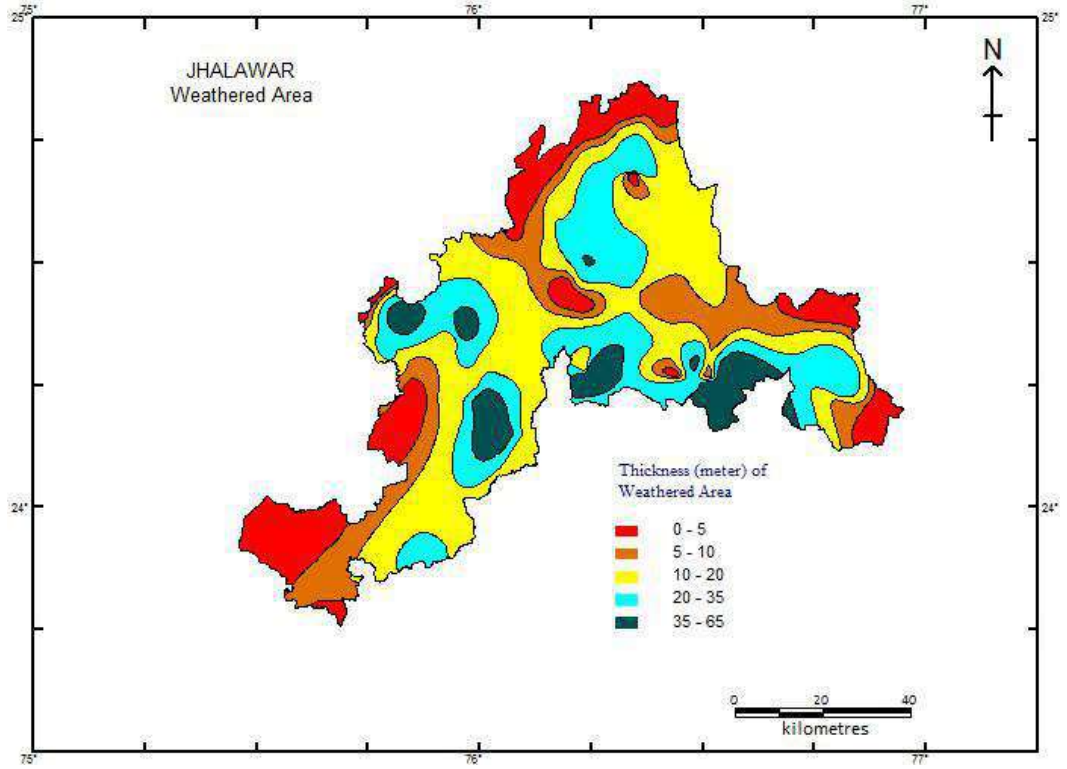


Figure 24: Weathered area thickness map

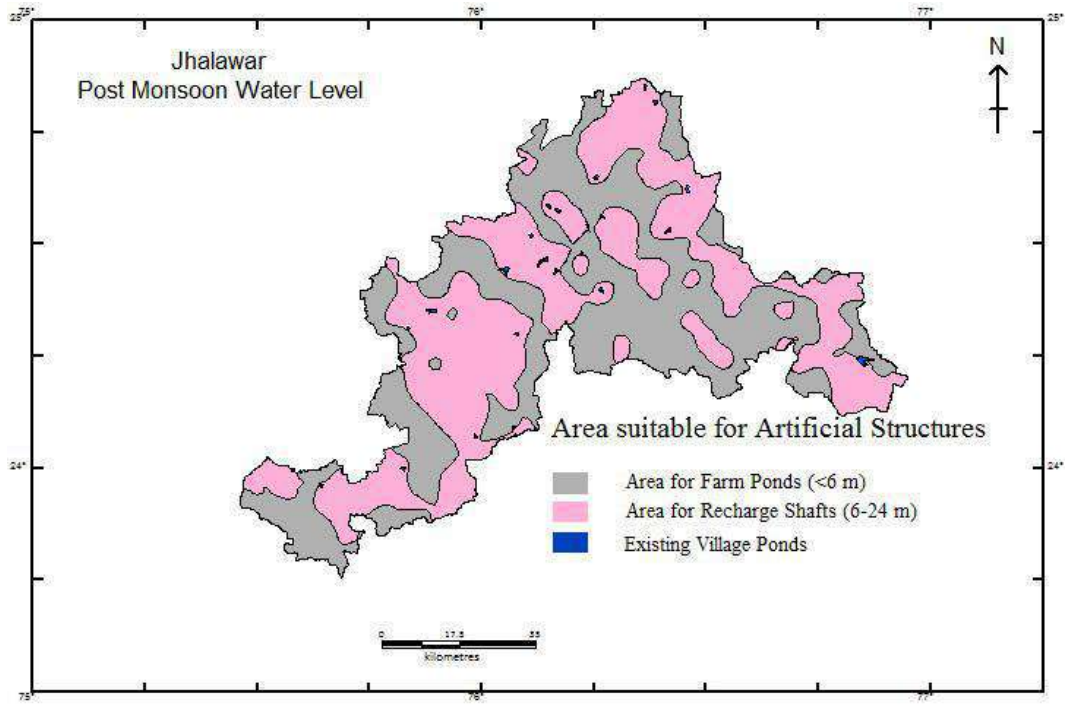


Figure 25: Post Monsoon water level map

The contour map showing total thickness of weathered area in the district gives the information about the total area suitable for recharge from the adequate surplus surface water which is available to recharge this volume. The most suitable areas are present in some parts of Pirawa (148.21 sq km), Bakani(205 sq km), Manohar Thana(91 sq km) and Jhalrapatan(53.94 sq km) with total thickness ranging from 35 to 65 meters. Whereas small

parts of Dag and Khanpur have suitable sites for recharge, ranging from 10 to 35 meters.

Table 6: Favourable weathered thickness and area.

Thickness of weathered layer (meters)	Area available under that thickness (sq km)	Weathered area (%)
0 – 5	1042.25	14.14
5 – 10	2115.4	28.69
10 – 20	2260	30.66
20 – 35	1474	19.99
35 - 65	480.67	6.52

The post monsoon underground water level map shows the water logged conditions in mostly south western and south eastern parts of the Jhalawar district. The maximum depth available to recharge the ground water is shown in small parts of Pirawa(19.58 sq km) and Jhalrapatan (8.46 sq km), ranging the depth from 18 to 24 meters.

The basin wise and watershed wise surplus surface water availability at 75% dependability level was obtained from the Water Resources Department of Govt. of Rajasthan for calculation of surplus surface water. The available surplus runoff can be utilised for artificial recharge through construction of recharge shafts in existing ponds and Percolation tanks at suitable location. The number of Recharge Shaft is decided based on the number of suitable ponds available within the zone. If still some surplus remains unallocated, than few Percolation tanks can be proposed at suitable locations. Thus, the entire surplus available cannot be utilised in some areas where suitable ponds for recharge shaft of suitable locations for percolation tanks are not available. Besides, the areas with shallow water levels (less than 6 m bgl) are also to be excluded.

8.1.1. Recharge shafts have been designed in a manner that maximum surplus water would likely to be utilized for recharge as well as sufficient water is retained in the pond for local use. According to Ground Water Department, Government of Rajasthan, major features required are:

- The well should have sufficient diameter for recharge- 10 to 12 inch diameter well with bottom screen/ opening just above the highest ground water level.
- The well should have screen/ opening at the top, which should be at least 1.5m above the bed level of the pond.
- The upper opening should be surrounded with filter pack comprising graded filter media of medium, coarse sand & gravel, so that the Recharge well does not get silted.

The opening for inflow to the well has been proposed at 1.5m above Bed level of pond. This is necessary to ensure that the pond retains sufficient water for use by local consumers. However, this may necessitate further deepening of pond itself so that the pond is 3-4 m deep. A Single well as discussed above would be suitable for a pond upto area of about 5ha. Therefore, more number of such Recharge wells is envisaged for larger ponds. The total number of 23 recharge shafts can be constructed in the district.

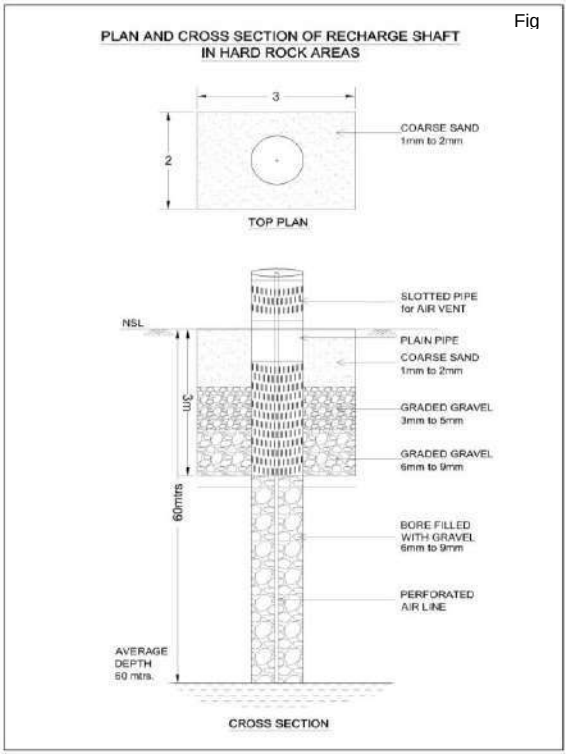


Figure 26: Recharge Shaft

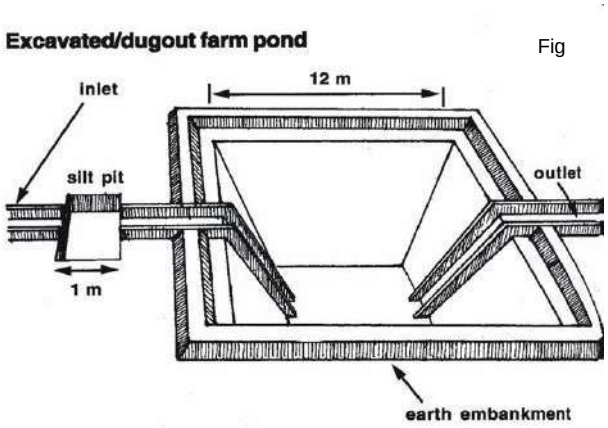
Table 7: Tentative location of the village ponds is given below

Block	Village	Long	Lat	Pond area (ha)	Formation	No of Shafts
Khanpur	Harigarh	76.2539	24.6492	0.657456	Sandstone	1
Jhalrapatan	Ralayta	76.1489	24.5842	0.535459	Sandstone/Shale	1
Jhalrapatan	Pirathvi Pura	76.2686	24.5617	0.516069	Sandstone/Shale	1
Jhalrapatan	Neemoda	76.1091	24.5186	0.361108	Basalt	1
Bakani	Deewri	76.2214	24.4793	0.336557	Basalt	1
Jhalrapatan	Dhabli Kalan	76.1653	24.4384	0.608093	Basalt	1
Bakani	Bhavpura	76.2656	24.3961	0.696257	Basalt	1
Jhalrapatan	Bhaisani	75.8357	24.3121	0.327521	Basalt	1
Pirawa	Mathaniya	76.0791	24.2985	0.356298	Basalt	1
Pirawa	Sar Kheri	76.0715	24.0891	0.31478	Basalt	1
Pirawa	Peepaliya	75.9859	24.0723	0.32811	Basalt	1
Dag	Jeta Kheri	75.6426	23.961	0.369479	Basalt	1
Jhalrapatan	Ralayta	76.169	24.5746	0.810839	Sandstone/Shale	1
Jhalrapatan	Saranga Khera	76.1365	24.4621	1.19809	Basalt	1
Jhalrapatan	Mogra	75.8873	24.351	1.19133	Basalt	1
Jhalrapatan	Girdharpura	76.2361	24.536	0.370913	Sandstone/Shale	1
Jhalrapatan	Dhabli Khurd	76.0524	24.4461	1.84075	Basalt	1
Dag	Kolvi	75.8246	24.0015	0.591015	Basalt	1
Khanpur	Salki Doongri	76.4138	24.5296	0.418458	Sandstone	1
Khanpur	Bhoomri	76.4579	24.6234	1.17884	Sandstone	1
Manohar Thana	Ladpura Balram	76.8489	24.2448	3.44333	Basalt	1
Khanpur	Jolpa	76.3636	24.8499	0.622926	Sandstone	1
Khanpur	Bohra	76.3862	24.816	0.67141	Sandstone	1

Recharge shafts are also proposed on different category percolation tanks constructed under MJSA programme during different phases (Location available in Annexure-VIII).

8.1.2. Farm Pond is a large hole dug out in the earth, usually square or rectangular in shape, which harvests rainwater and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available, the type of soil, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. Water from the farm pond is conveyed to the fields manually, by pumping, or by both methods. The various advantages of farm ponds are as follows:

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees, thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimize siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock
- They promote fish rearing.
- They recharge the ground water.
- They improve drainage.
- The excavated earth has a very high value and can be used to enrich soil in the fields, levelling land, and constructing farm roads



Fig

It is proposed to construct 85243 farm ponds as per the specification of Govt. of Rajasthan (30 x 30 x 3 m). Considering 3 fillings this can accommodate 230.16 MCM of runoff rainfall. Farm ponds can be constructed in the village at feasible location. The total

area available for farm ponds is 728.1 Sq Km but dimension of the farm pond depends on land holdings.

Table 8: Supply side management

Block	Potenital Zone area (sq. km.)	Volume of sub surface storage space available for artificial recharge (mcm)	Surplus available as per Tahal Report (in mcm)	No. of RS (0.03 MCM/RS)	No of RS possible in block (as per water bodies)	25% of Remaining Surplus water for Recharge and Conservation	Surplus for Farm pond (0.0027 MCM)	No of Farm Pond
Bakani	865.98	43.47	144.96	4832	1194	27.29	27.29	10106
Dag	1087.09	75.99	185.27	6176	484	42.69	42.69	15811
Jhalrapatan	1299.62	118.27	213.65	7122	600	48.91	48.91	18116
Khanpur	932.90	115.87	151.74	5058	153	36.79	36.79	13625
Manoharthana	919.97	58.79	158.02	5267	414	36.40	36.40	13482
Pirawa	1000.60	72.04	167.05	5568	491	38.08	38.08	14104
Total	6106.16	484.42	1020.70	34023	3336	230.16	230.16	85243

8.1.3. Anicut: To maintain the groundwater level, anicuts can also be constructed. Anicut is a dam made in stream for maintaining and regulating irrigation. As its primary purpose is retaining water which helps in increasing the contact time due to which surface water percolates down to recharge the underground water.

The other way of reducing groundwater draft is by promoting construction of surface water reservoirs. These reservoirs can be linked and then further channelized into water scarce areas. The revival of existing water storage structures like *bawaris* and step wells is also equally important for hygiene and their sustainability. In saline areas the farm ponds can serve as occupation of saline water fisheries as those areas are not suitable for productive agricultural practices. Apart from surface storage, non farmers can conserve the rainwater in underground tanks, as per their land holdings, through rainwater harvesting and share among them with mutual consent. The pre-monsoon water scarcity can be compensated by their conservation of rainwater stored during monsoon season. There are 73 numbers of schools in the district if practice of rain water harvesting stats there then also good volume of water can be conserved. In case of lack of space, the underground tank or *taanka* for retaining rainwater can be used as elevated platform or stage for conducting various school activities. The rain water harvesting can also be done at abandoned queries which can be used during scarcity of water.

8.2 Demand Side Management :

The stage of development can be brought down to a level 70.79% (safe category) level by implementing supply side management However demand side management can be used for future ground water sustainability.

By applying the techniques of demand side management can save large amount of water. Demand side management may be proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea).

Water Saving

Considerable saving of ground water can be achieved if the proposed supply side and demand side management plans are implemented. With the implementation of supply side management, additional 215.16 MCM/year can be recharged. This would increase the replenishable recharge to ground water from 546.81 MCM/year to 761.96 MCM/year.

It can be seen that not much augmentation in ground water resources can be achieved through artificial recharge due to constraints of availability of surplus/non-committed surface water. However, considerable improvement in ground water situation can be achieved with implementation of demand side management plans.

With the proposed use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water it is expected that 118 MCM/year can be saved due to reduction in pumping and with changing the wheat crop to gram (chick pea) and additional 46MCM/year can be saved due to reduction of pumping. Whereas with the proposed use of drip irrigation in the areas cultivated under oranges it is expected that 28 MCM/year can be saved. With implementation of these three interventions, a total of 192 MCM/year can be saved. This may lead to a total reduction in ground water draft from 539.39 MCM/year to 327.59 MCM/year. And with this the stage of ground water development may come down from 98.66 to 59.83%. These interventions may progressively lead to further improvement in ground water situation over the years.

Table 9: District wise details of ground water harvesting/conservation and expected improvement in stage of ground water development

Block	Net G.W. Availability (mcm)	Additional Recharge from RWH & conservation (mcm)	Total Net G.W. Availability after intervention (mcm)	Existing G.W Draft for all purpose (mcm)	Present stage of G.W. development (%)	Projected stage of G.W. Dev. (in %)
Bakani	85.2513	49.46	134.71	83.71	98.20	62.14
Dag	83.797	35.86	119.66	74.61	89.04	62.35
Jhalrapatan	106.4045	42.46	148.86	104.55	98.26	70.23
Khanpur	83.0305	22.98	106.01	91.03	109.63	85.86
Manoharthana	89.8764	30.62	120.50	87.18	97.00	72.35
Pirawa	98.447	33.77	132.22	98.31	99.86	74.35
Total	546.8067	215.16	761.96	539.39	98.66	70.79

After implementing proposed projects the projected stage of groundwater development is calculated as 70.79% which means apart from current available ground water i.e. 547.0 mcm there can be additional groundwater available in the district i.e. 215.16 mcm. This additional water can be used for irrigation in wastelands of around 1048.22 sq km. As the total wasteland present in the district is 2567.42 sq km where 1057.98 sq km is the land affected by salinity/alkalinity which can be restored and irrigated. Rest of the wasteland comprises deep/shallow ravine land can also be restored and irrigated after land levelling which will reduce the water usage. The increase in irrigated area will help in the socio-economic development of the district.

8.3 The difficulties observed in drilling and construction of borewells in deccan traps specially penetrating different flows and intertrappeans (Red & Green balls formation) can be solved by use of higher psi compressor in DTH Rigs and use of part assembly pipes (Blank/ slotted) in inter-trappeans bed of sticky clayey nature.

8.4 The recharge structure constructed under MJSA (Mukhyamantri Jal Swavlamban abhiyan) during different phases by the rajasthan state government, their locations & details in tabulated form of Jhalawar district are as follows:

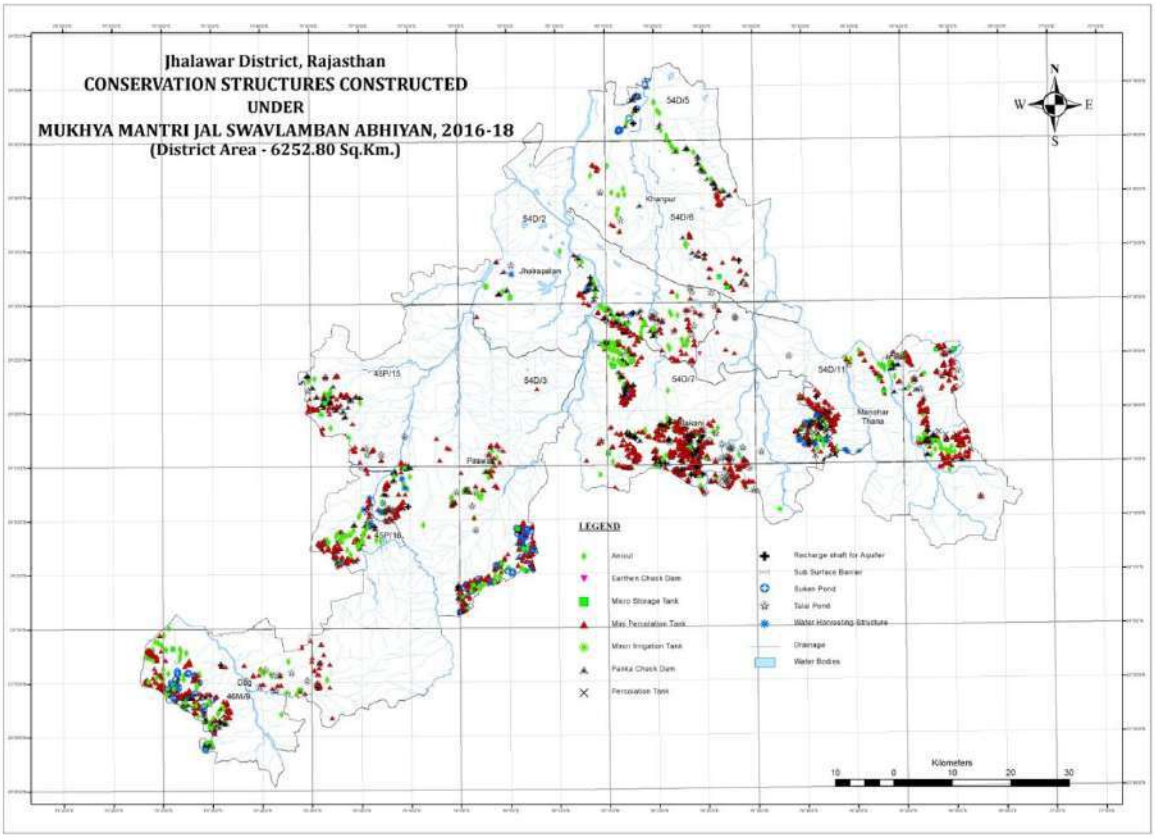


Figure 27: Map showing locations of different type of recharge structures constructed under MJSA.

Table-10: Showing Cummulative Recharge structures constructed in Jhalawar district during three phases of MJSA

S. No.	Type of Structures	Aklera	Bakani	Bhavani mandi	Dag	Jhalra patan	Khanpur	M.Thana	Pirawa	Total district
1	Anicut	22	48	50	90	48	33	43	50	**384**
2	Earthen check dam (ECD)	0	1	0	1	1	0	0	0	**3**
3	Micro storage tank	7	6	3	5	2	2	7	10	**42**
4	Mini percolation tank	143	16	91	200	54	35	298	248	**1085**
5	MPT	363	330	100	85	88	25	4	60	**1055**
6	Pakka check dam	53	55	52	44	47	40	36	31	**358**
7	Percolation Tank	23	2	6	3	8	0	8	12	**62**
8	Recharging shaft	23	15	3	2	2	4	1	4	**54**
9	Sunkhen pond, Talai (Talab)	64	5	8	52	20	14	16	70	**249**
10	W. harvesting structure	16	0	8	0	3	0	0	4	**31**
11	Minor Irrigation tank	0	2	6	0	0	0	1	2	**11**
12	Sub surface barrier	0	0	0	2	0	0	0	0	**2**
	Total	**714**	**480**	**327**	**484**	**273**	**153**	**414**	**491**	**3336**

8.5 The study on the impact assessment on change in ground water scenario of Jhalawar district after construction of these recharge structures is to be carried out.

Part B

Management Plans of Blocks of Jhalawar District

Aquifer mapping is a scientific process wherein a combination of geological, geophysical, hydrological and chemical fields and laboratory analyses have been applied to characterized 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 changes 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.

Under the National aquifer Programme, it is proposed to generate Aquifer Maps on 1:50000 scale, which basically aims at characterizing the aquifer geometry, behaviour 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 include compilation of existing data, identification of data gaps, generation of data for feeling data gaps and preparation of different aquifer layers.

To get a clear 3D hydro-geological geometry of the aquifer system and water level behaviour, it was felt to generate more data through Groundwater Exploration, VES and to establish more numbers of monitoring stations for better understanding of the groundwater regime behavior in terms of both quantity and quality.

Jhalawar district is located between 23^{o} 45’ 20” and 24^{o}52’17” North latitude and 75^{o} 27’35” and 76^{o}56’48” East longitude covering an area of 6253 sq.km. The district is part of Kota Division and is divided into five sub-divisions namely Aklera, Khanpur, Jhalawar, Pirawa, and Bhawanimandi. Administratively the district is divided into 7 tehsils and 6 development blocks (Fig. 28).

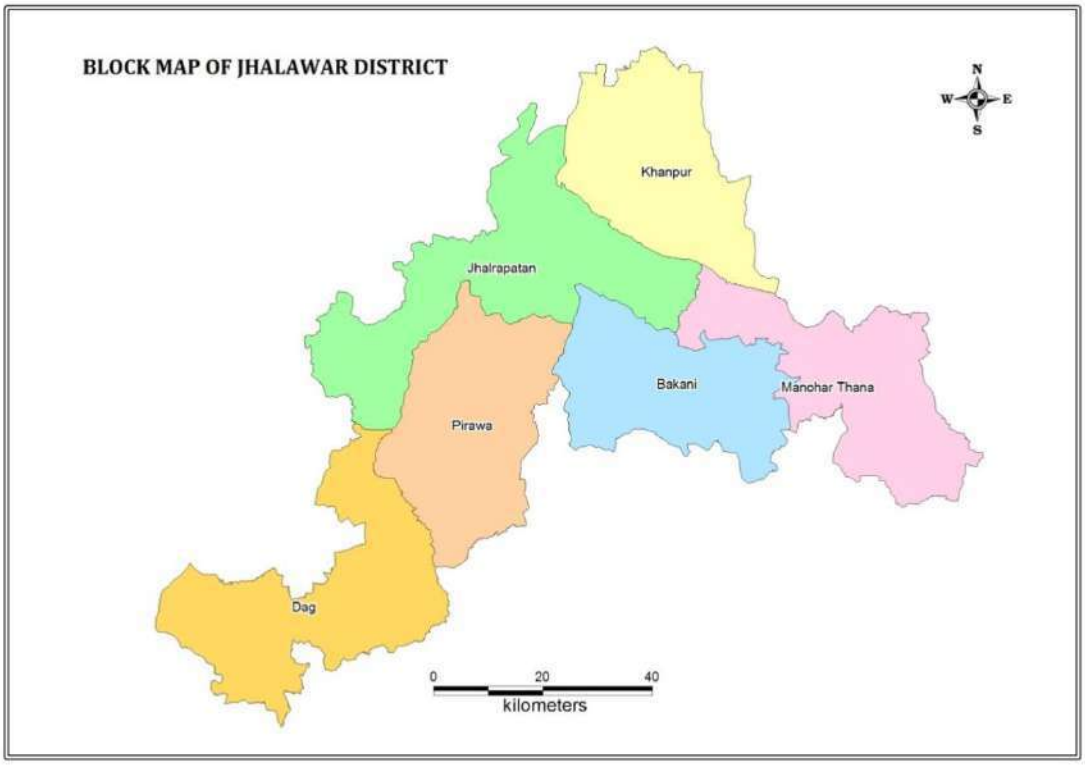


Fig. 28: **Showing administrative boundaries of blocks of Jhalawar district**.

The long term Hydrographs for selected stations have been presented below. In the following block wise hydrographs, the post monsoon water level is higher than the pre monsoon water level. Since 2007, the annual rainfall in all the blocks has been increased except in the dag block.

Similarly in the hydrograph of whole district the post monsoon water level is higher than the pre monsoon water level. The probable reasons of such results are:

- Increase in rainfall except Dag block where 2800 mm was recorded in 2007 which has been decreased to 1400mm in 2016 year.
- The rate of recharge has also been increased as in 2004 it was 430.82 mcm and in 2013 it becomes 546.8 mcm.

The self-explanatory maps of each block units like Geomorphology, Land use, Location map of exploratory wells drilling locations, Aquifer system, Fence diagrams (cross-sections & 3-D vertical sections), Depth to Water (Pre & Post monsoon), Hydrographs and Quality Maps are prepared along with management plans and the artificial recharge structures constructed by the Rajasthan state government under MJSA in different phases are as follows:

(a) **Bakani :** The Bakani block is surrounded by the Manoharthana in east, Jhalra patan in north, Pirawa in west and state of Madhya Pradesh towards southern direction.

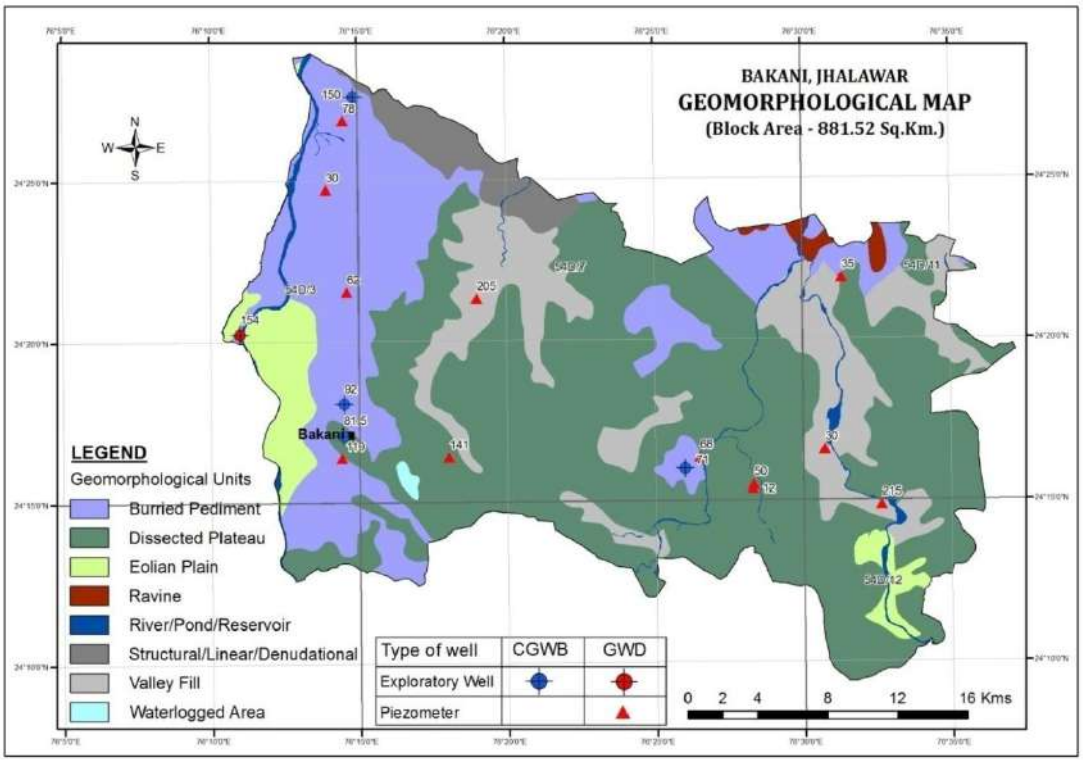


Fig. 29: Map showing Physiography & Drainage.

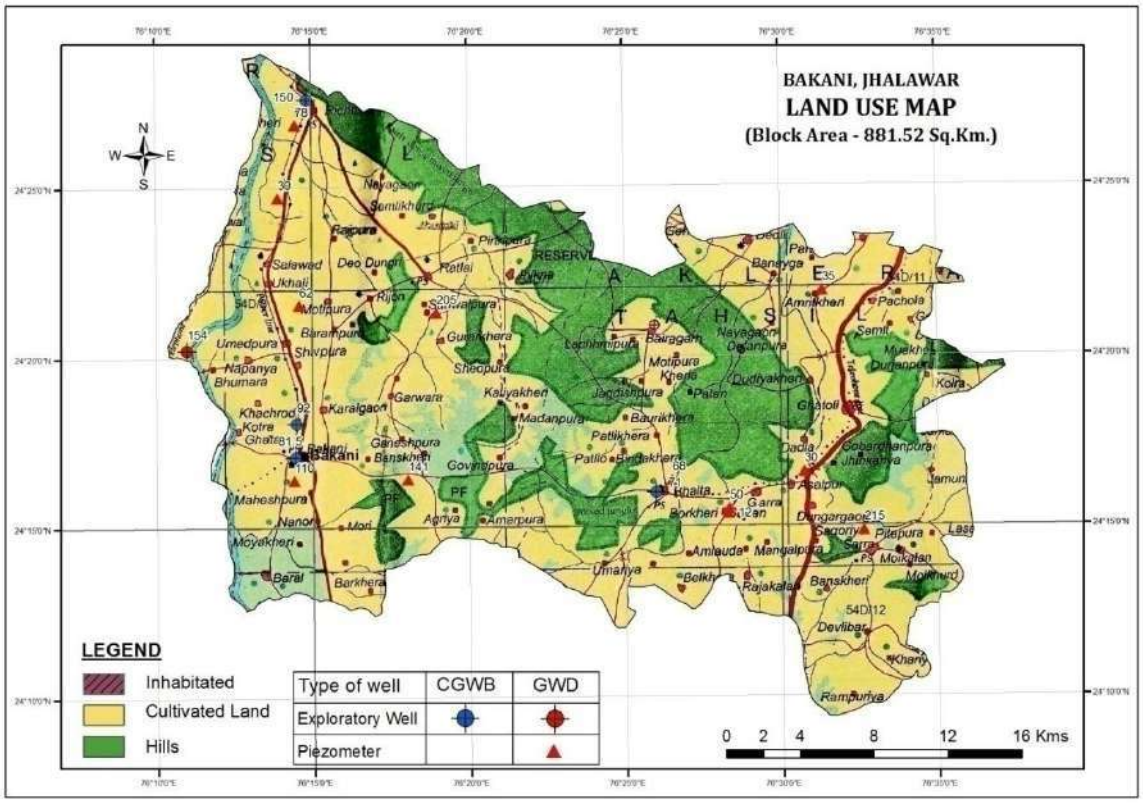


Fig. 30 : Map showing Land Use.

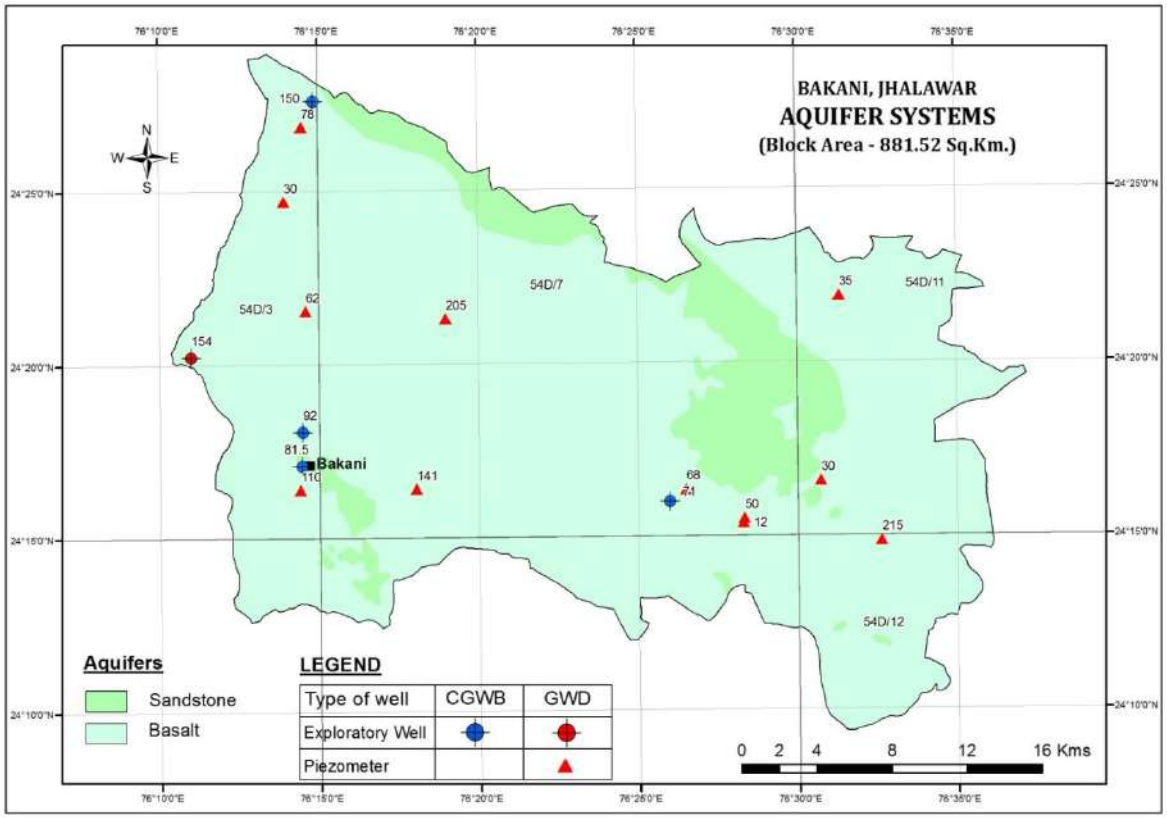
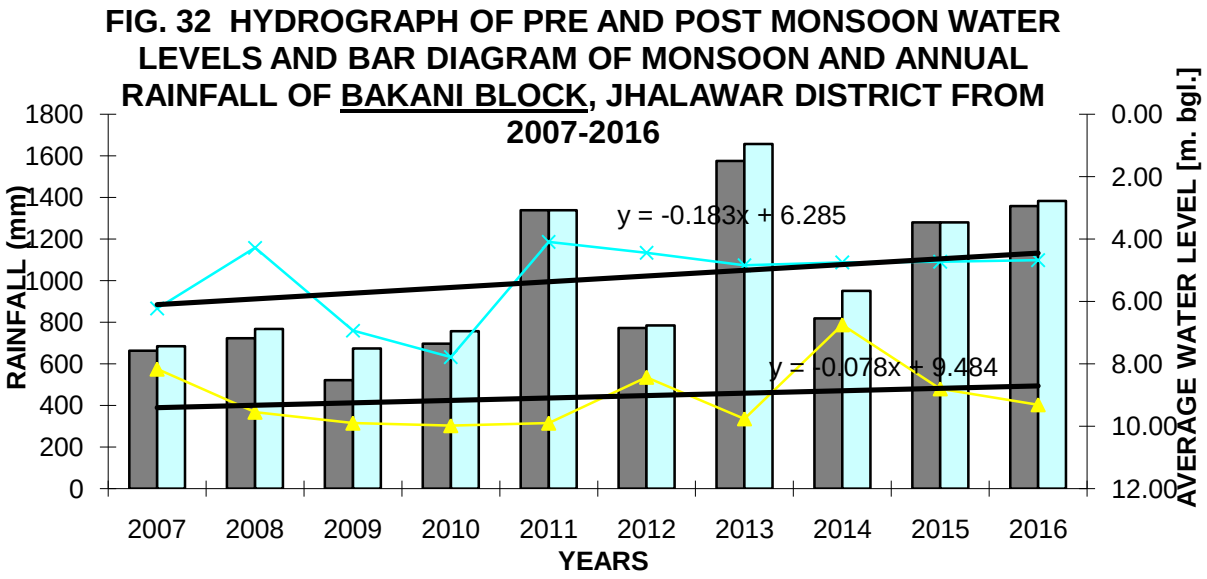


Fig.31 : Map showing Principal Aquifer.



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:

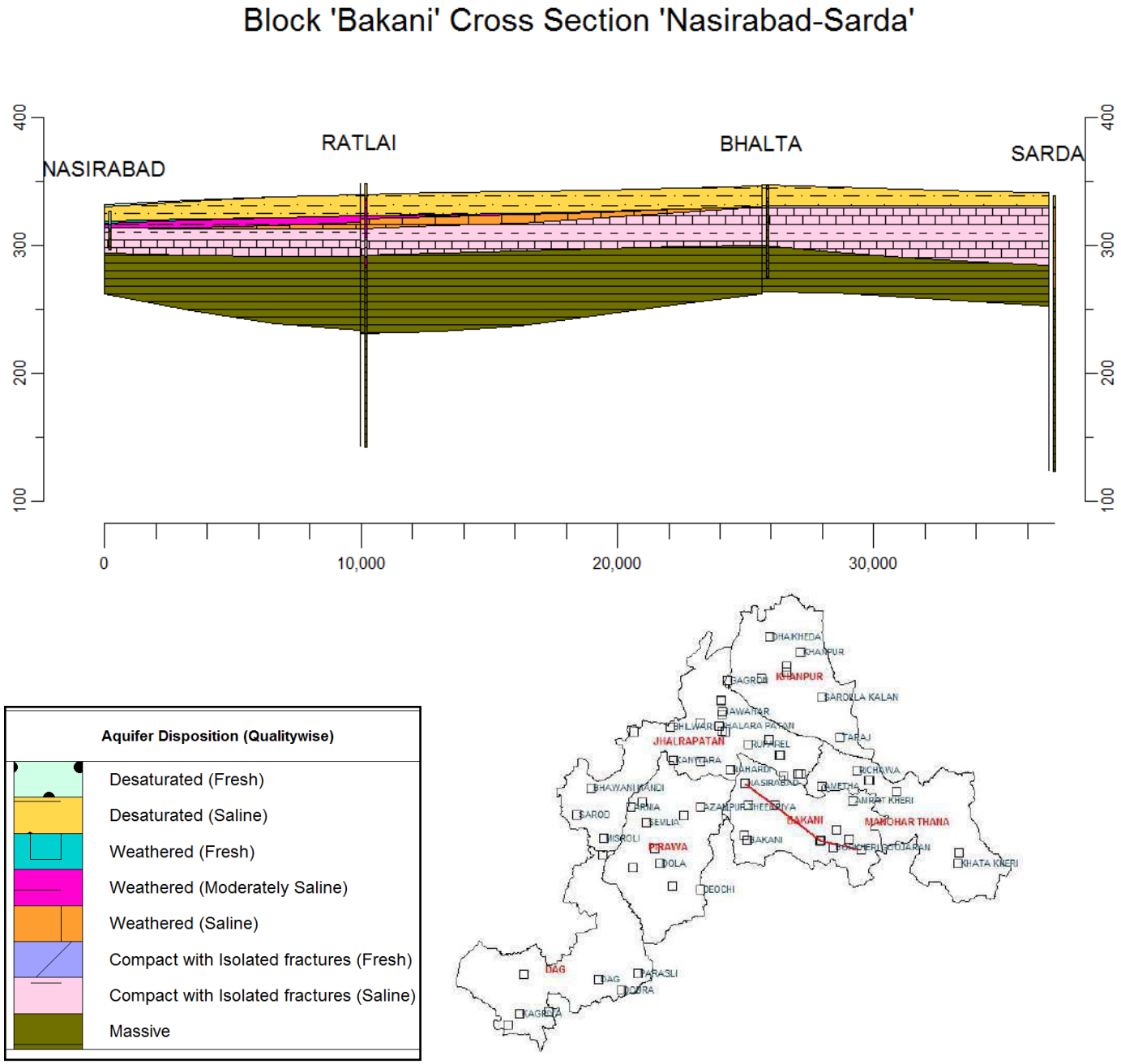


Fig. 33 :Map showing aquifer disposition.

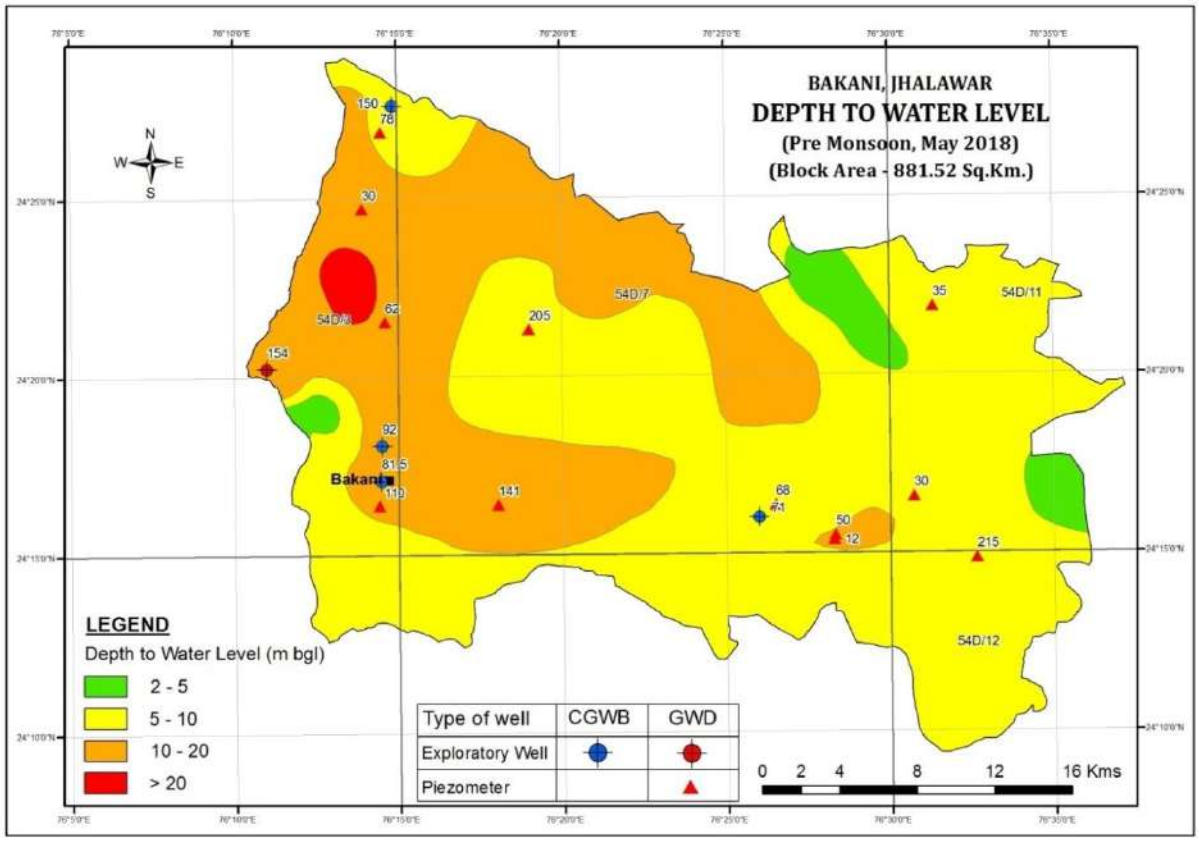


Fig.34 : Depth to Water Level (Pre Monsoon - May 2018)

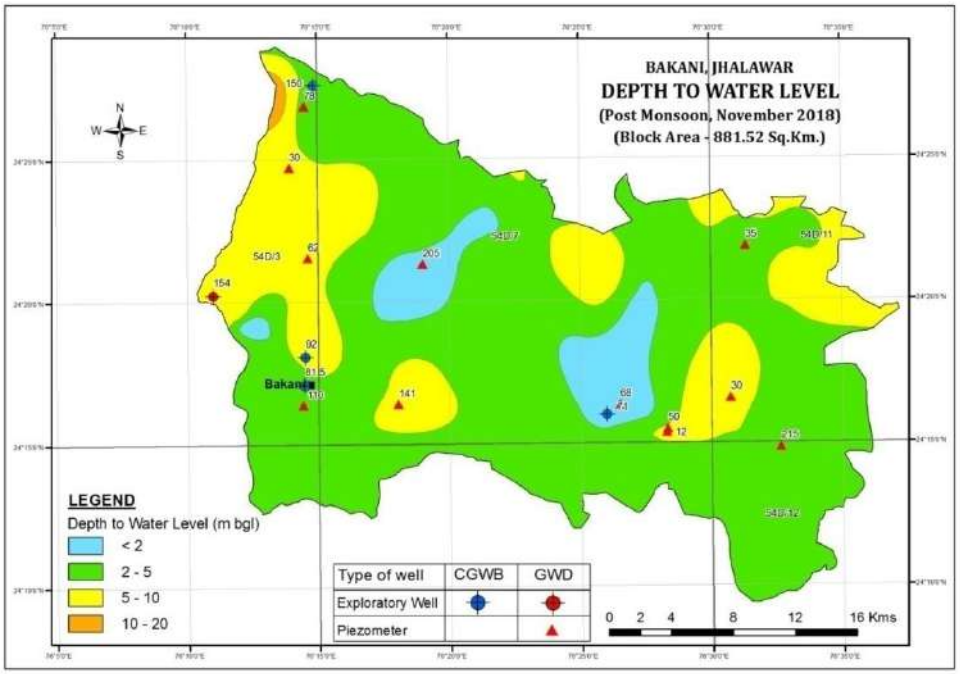


Fig.35 : Depth to Water Level (Post Monsoon - November, 2018)

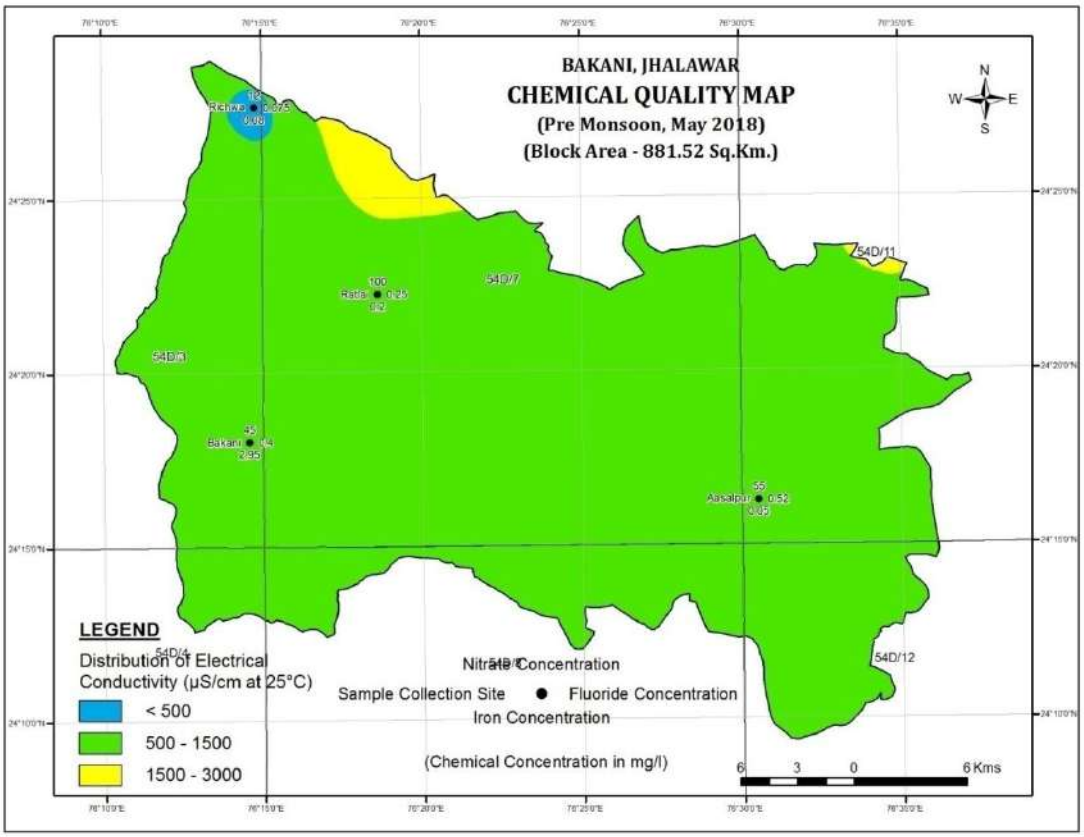


Fig.36: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

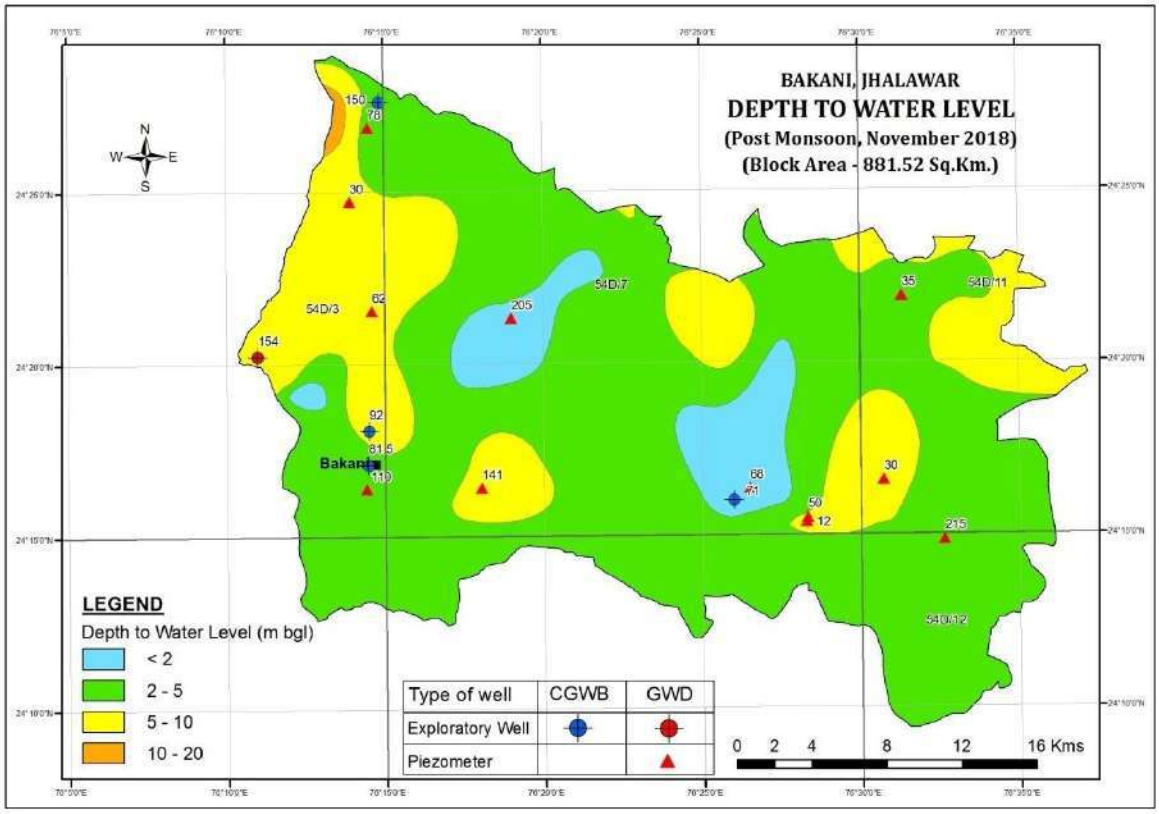


Fig.37: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

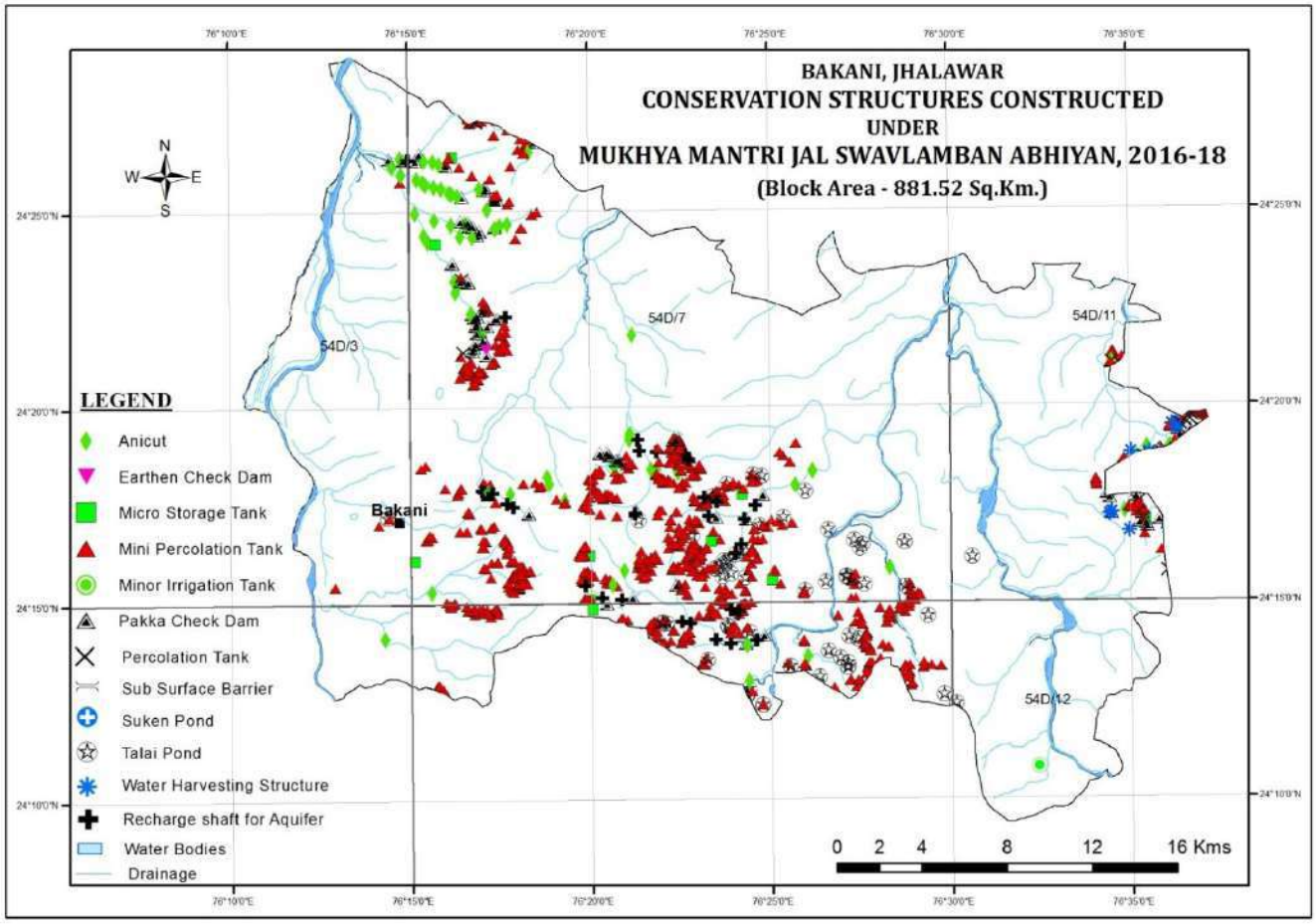


Fig. 38: Map showing locations of different type of recharge structures constructed under MJSA.

Management plan of Bakani Block

Salient Information	Block	Bakani
	Geographical Area (km2)	881.52
	Forest Area (Sq.km)	15.54
	Potential Area (Sq.km)	865.98
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2014)	1013.9 mm
Ground Water Issues	Aquifer Characteristics	Basalt, Unconfined Aquifer
	Main Aquifers in the area	Covered by Hard rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by Basalt
	Geology	Basalt
	Maximum Depth of Aquifer in meter	63.5
	Type of Aquifer	Unconfined Aquifer
	Thickness of Aquifer (Utilisable)	33
	Hydraulic Characters (sp.yield%)	0.02
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	9.76
	Trend (m/yr)	0.14
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1308.2
	Chloride in mg/ litre (Min/Max)	172.12
	Nitrate in mg/litre (Min/Max)	46
	Fluoride in mg/litre (Min/Max)	0.39
Groundwater Resources	Total annual ground water recharge(mcm)	104.4094
	Natural discharge during non-monsoon season(mcm)	19.1581
	Net ground water availability(mcm)	85.2513
	Existing gross ground water draft for irrigation(mcm)	81.4447
	Existing gross ground water draft for domestic & industrial uses(mcm)	2.2702
	Existing gross ground water draft for all uses(mcm)	83.7149
	Allocation for domestic & industrial requirement(mcm)	5.4205
	Net ground water availability for future irrigation development(mcm)	6.3344
	State of ground water development	98.20
	Category	Critical
Supply Side Management	Space Available for Recharge (mcm)	865.98
	Area of Block (Sq.km.)	881.52
	Potential area suitable for recharge (Sq.km.)	865.98
	Area feasible for artificial recharge (Sq km)	865.98

Salient Information	Block	Bakani
	Thickness of unsaturated zone 3 m below ground level (m)	78.55
	Potenital Zone area (sq. km.)	865.98
	Volume of sub surface storage space available for artificial recharge (mcm)	43.47
	Surplus available as per Tahal Report (in mcm)	144.96
	No. of RS (0.03 MCM/RS)	4832.08
	No of RS possible in block (as per water bodies)	1194
	25% of Remaining Surplus water for Recharge and Conservation	27.28
	Surplus for Farm pond (0.0027 MCM)	27.28
	No of Farm Pond	10106
Expected Benefits	Net G.W. Availability (mcm)	85.25
	Additional Recharge from RWH & conservation (mcm)	49.46
	Total Net G.W. Availability after intervention (mcm)	134.71
	Existing G.W Draft for all purpose (mcm)	83.71
	Net GW draft after interventions (mcm)	83.71
	Present stage of G.W. development (%)	98.19
	Projected stage of G.W. Dev. (in %)	62.14
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

(b) **Dag :** The Dag block is surrounded by the state of Madhya Pradesh from most of the directions except in north & east by Jhalra patan and Pirawa

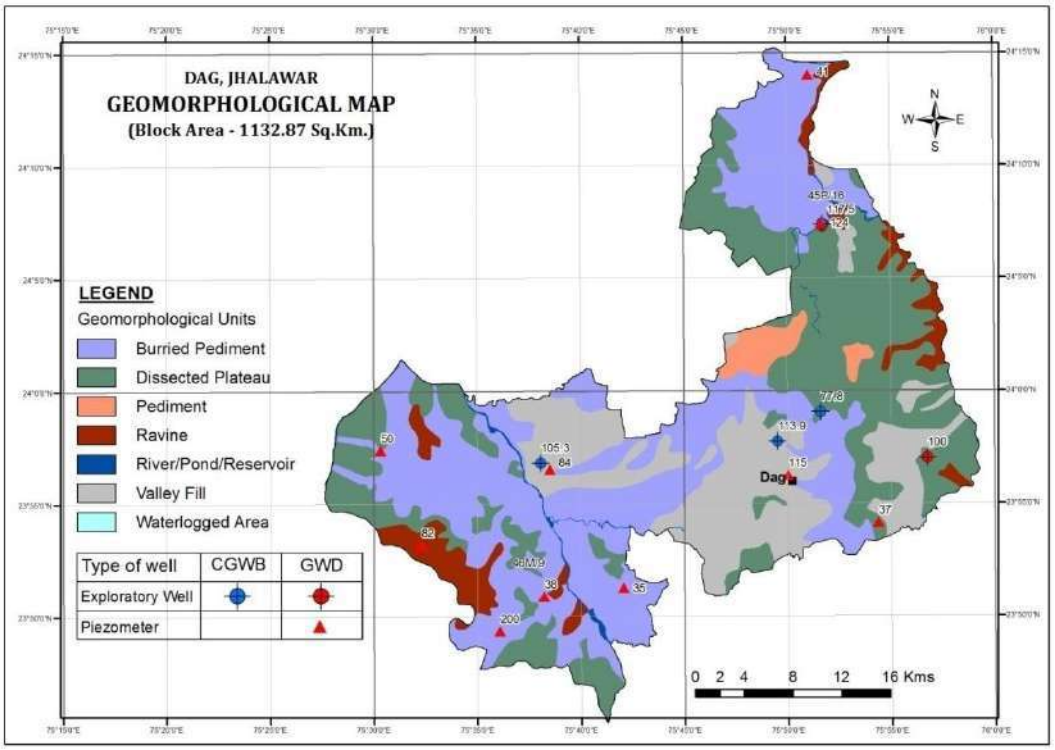


Fig. 39 : Map showing Physiography & Drainage.

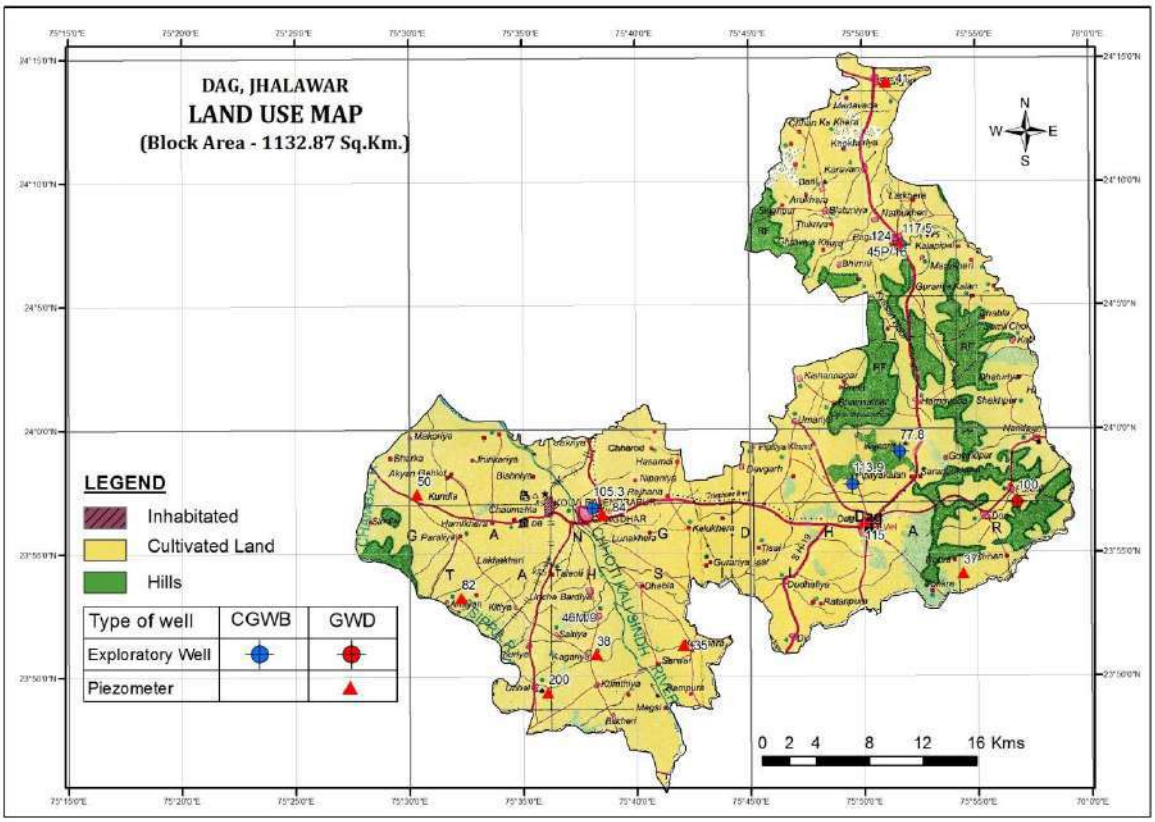


Fig. 40 : Map showing Land Use.

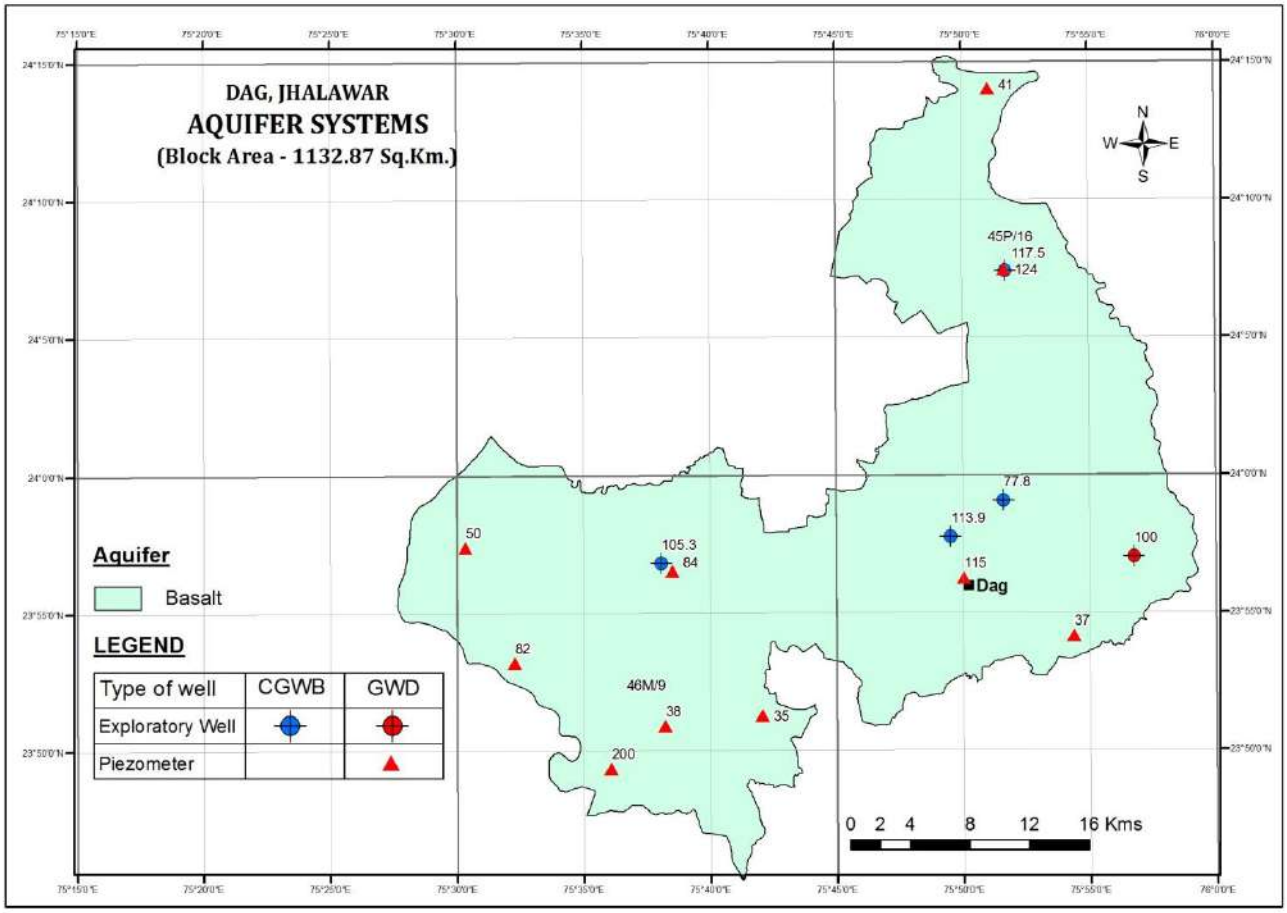
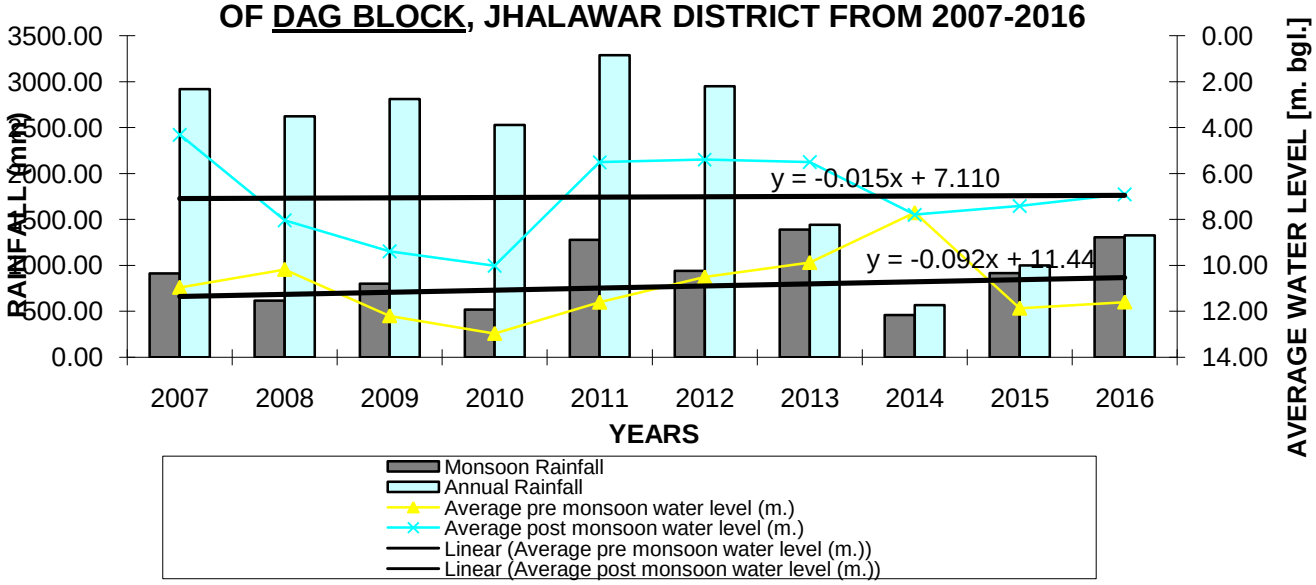


Fig.41 : Map showing Principal Aquifer.

FIG. 42 HYDROGRAPH OF PRE AND POST MONSOON WATER LEVELS AND BAR DIAGRAM OF MONSOON AND ANNUAL RAINFALL OF DAG BLOCK, JHALAWAR DISTRICT FROM 2007-2016



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:

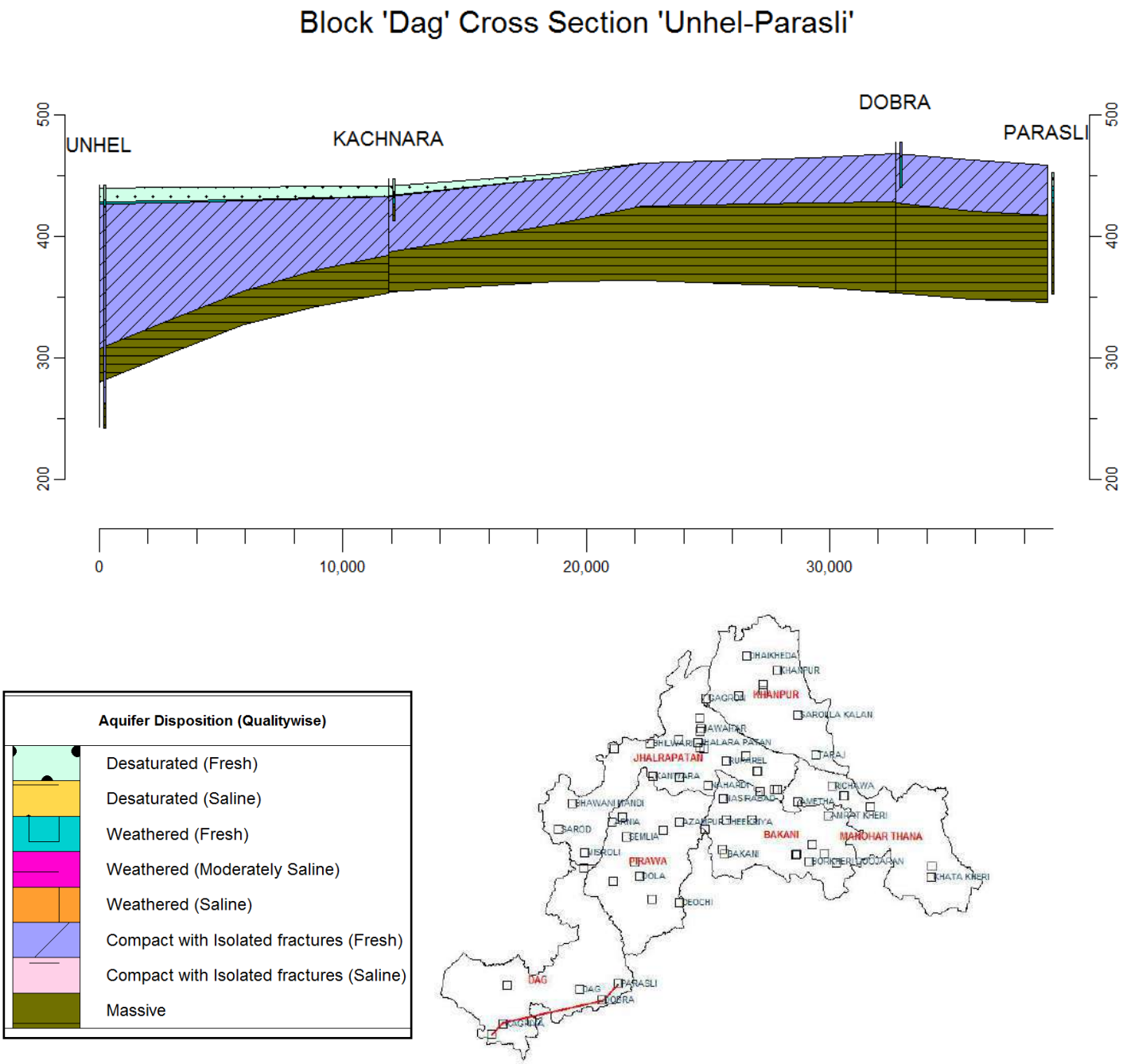


Fig. 43 :Map showing aquifer disposition.

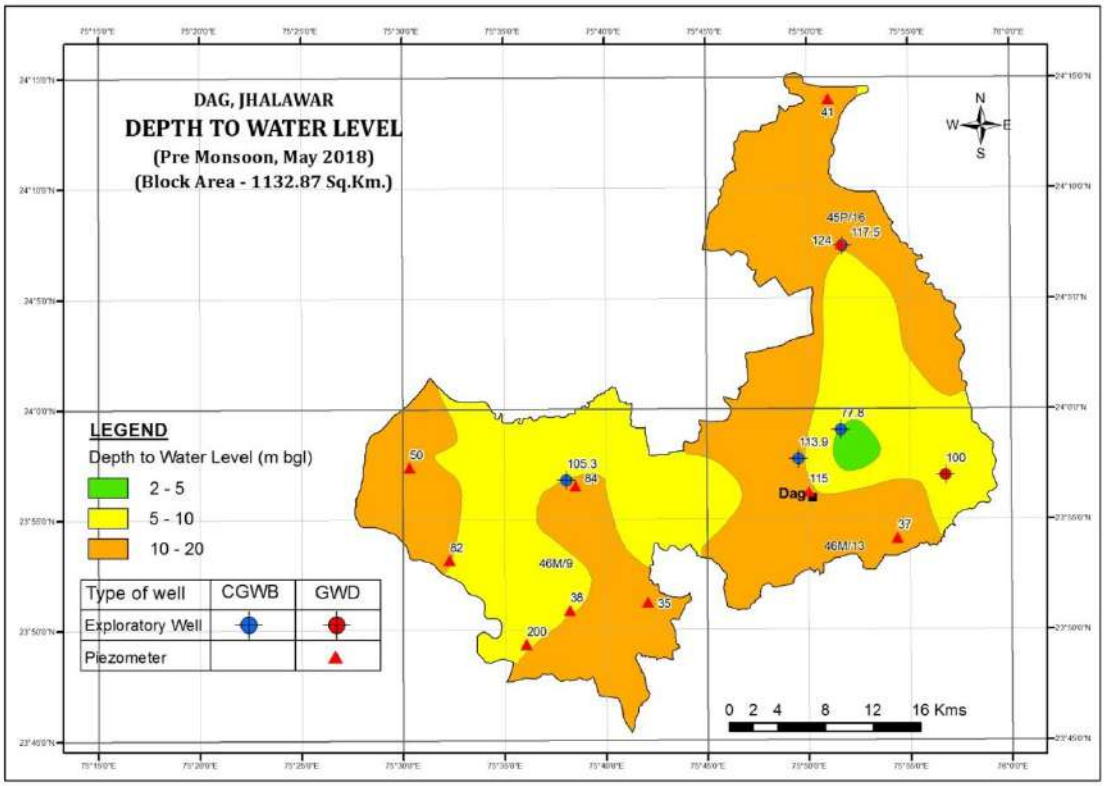


Fig. 44 : Depth to Water Level (Pre Monsoon - May 2018)

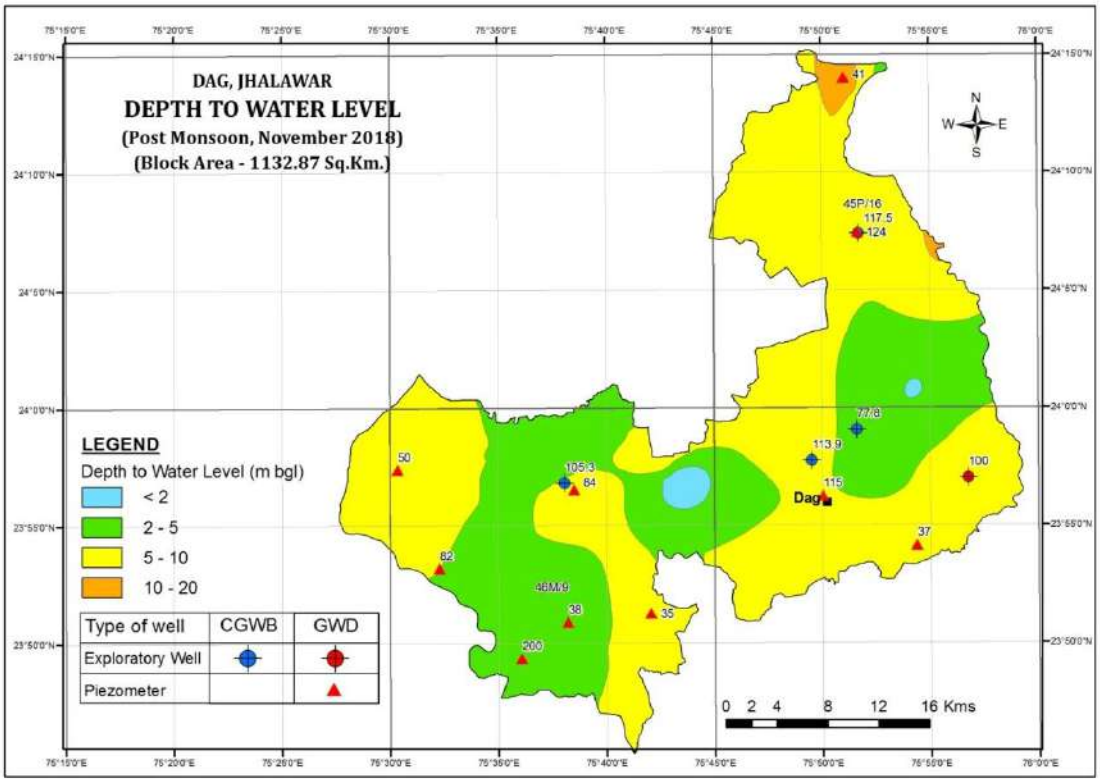


Fig.45 : Depth to Water Level (Post Monsoon - November, 2018)

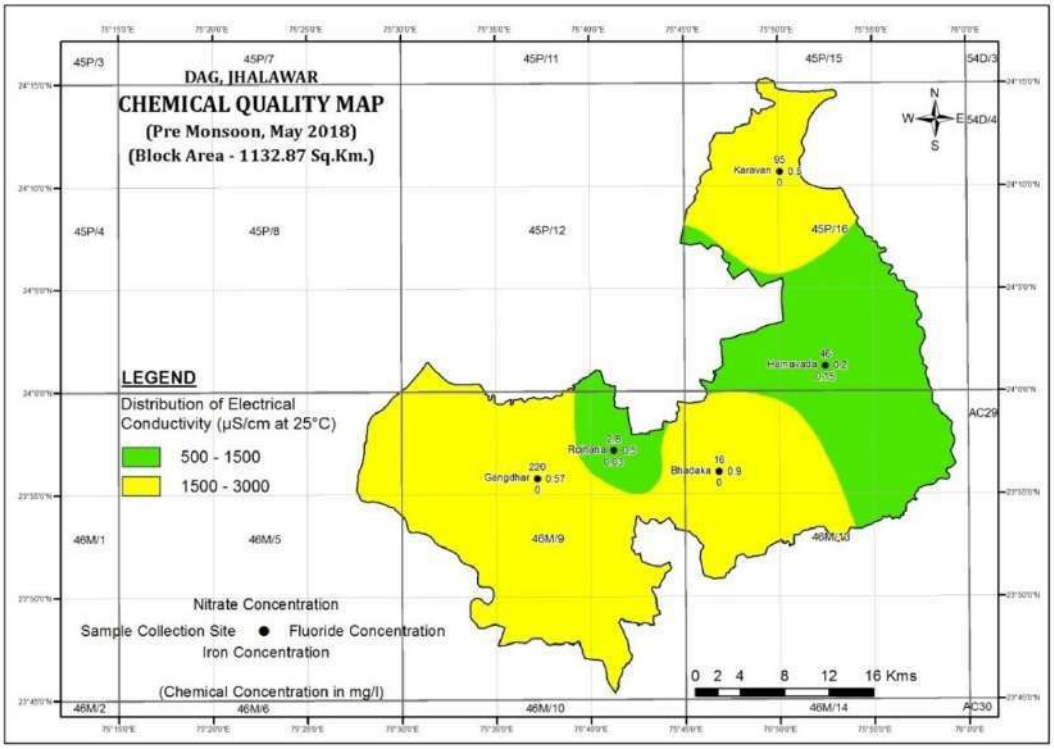


Fig.46: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

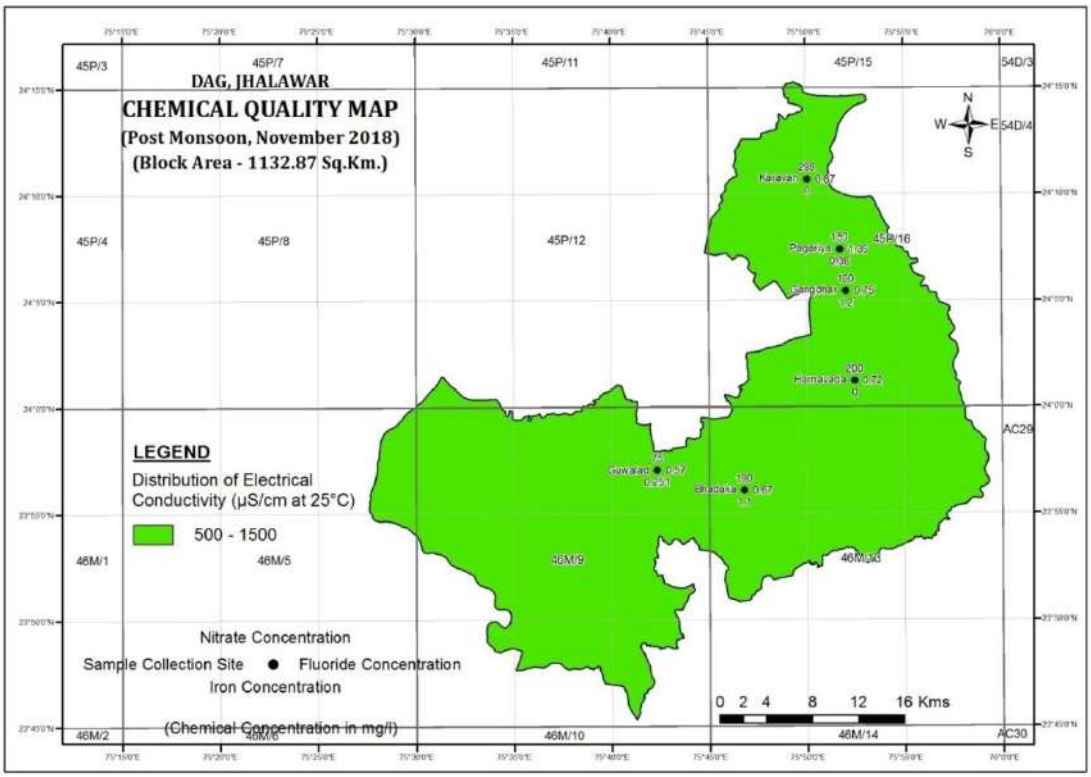


Fig.47 : Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

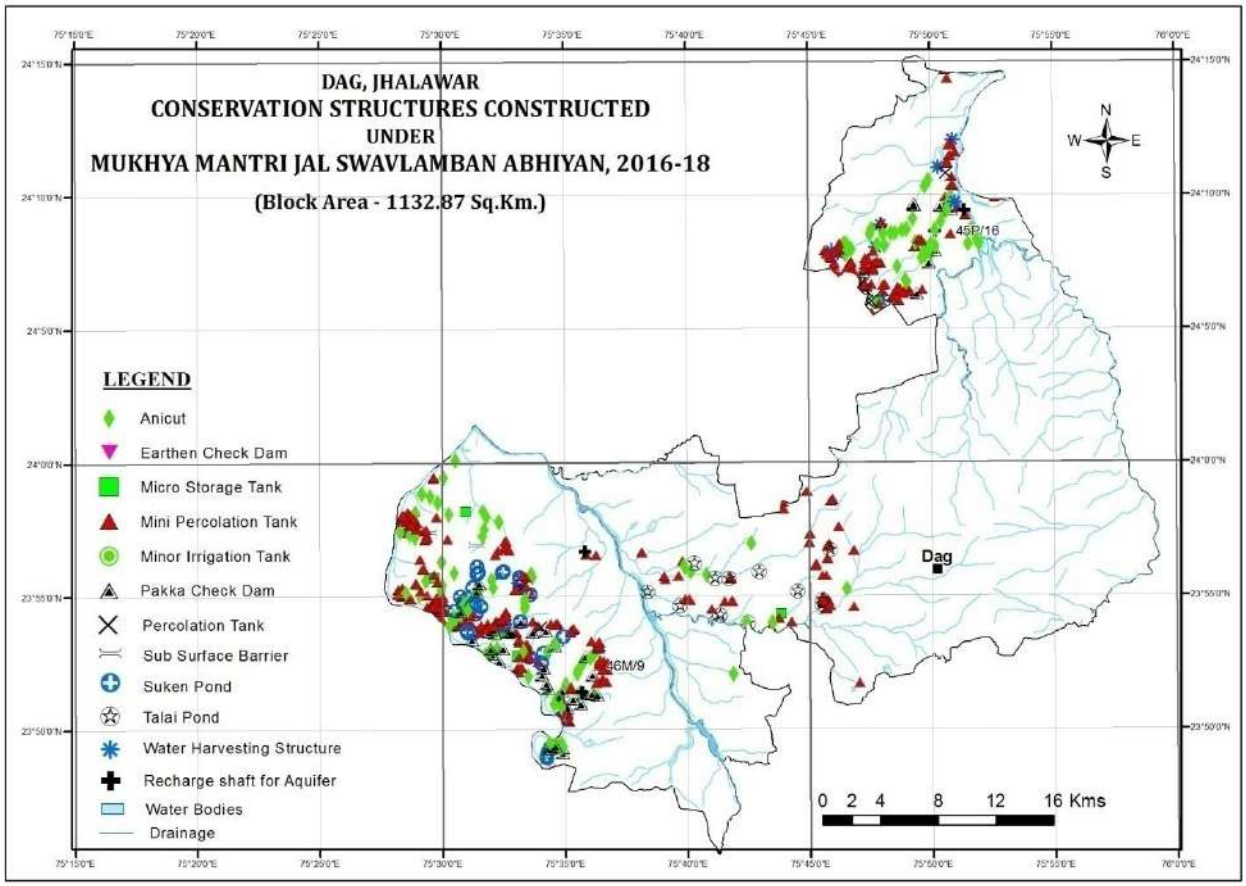


Fig.48 : Map showing locations of different type of recharge structures constructed under MJSA.

Management Plan of Dag Block

Salient Information	**Block**	**Dag**
	Geographical Area (km2)	1132.87
	Forest Area (Sq.km)	45.78
	Potential Area (Sq.km)	1087.09
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2016)	850.7 mm
Ground Water Issues	Aquifer Characteristics	Basalt and Unconfined aquifer
	Main Aquifers in the area	Occupied by hard rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by basalt
	Geology	Basalt
	Maximum Depth of Aquifer in meter	24.5
	Type of Aquifer	unconfined
	Thickness of Aquifer (Utilisable)	13.5
	Hydraulic Characters (sp.yield%)	0.015
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	11.69
	Trend (m/yr)	-0.33
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1308.2
	Chloride in mg/ litre (Min/Max)	172.12
	Nitrate in mg/litre (Min/Max)	46
	Fluoride in mg/litre (Min/Max)	0.39
Groundwater Resources	Total annual ground water recharge(mcm)	93.1078
	Natural discharge during non-monsoon season(mcm)	9.3108
	Net ground water availability(mcm)	83.7970
	Existing gross ground water draft for irrigation(mcm)	70.3620
	Existing gross ground water draft for domestic & industrial uses(mcm)	4.2469
	Existing gross ground water draft for all uses(mcm)	74.6089
	Allocation for domestic & industrial requirement(mcm)	0.4518
	Net ground water availability for future irrigation development(mcm)	6.0029
	State of ground water development	89.04
	Category	Semi-critical
Supply Side Management	Potenital Zone area (sq. km.)	1087.09
	Volume of sub surface storage space available for artificial recharge (mcm)	75.99
	Surplus available as per Tahal Report (in mcm)	185.27

Salient Information	Block	Dag
	No. of RS (0.03 MCM/RS)	6175.83
	No of RS possible in block (as per water bodies)	484.00
	25% of Remaining Surplus water for Recharge and Conservation	42.69
	Surplus for Farm pond (0.0027 MCM)	42.69
	No of Farm Pond	15811
Expected Benefits	Net G.W. Availability (mcm)	83.80
	Additional Recharge from RWH & conservation (mcm)	35.86
	Total Net G.W. Availability after intervention (mcm)	119.66
	Existing G.W Draft for all purpose (mcm)	74.61
	Net GW draft after interventions (mcm)	74.61
	Present stage of G.W. development (%)	89.04
	Projected stage of G.W. Dev. (in %)	62.35
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

(c) **Jhalra patan :** The Jhalra patan block is surrounded by the state of Madhya Pradesh & Kota district of Rajasthan state in the west, Pirawa & Bakani blocks in south and North east by Khanpur & Manohar thana respectively.

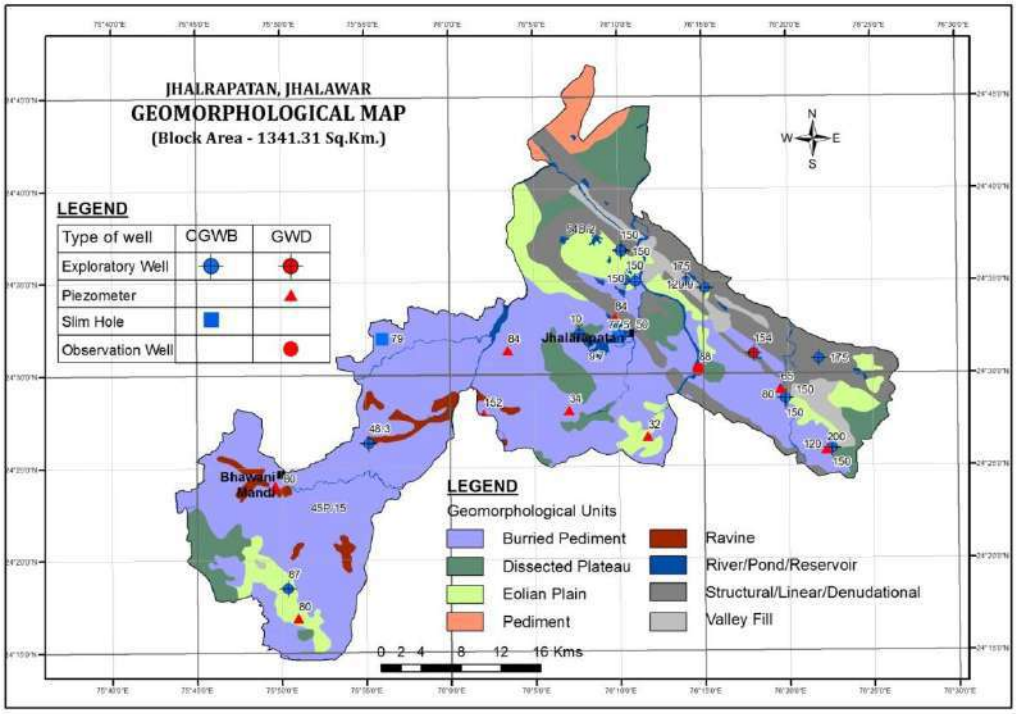


Fig. 49 : Map showing Physiography & Drainage.

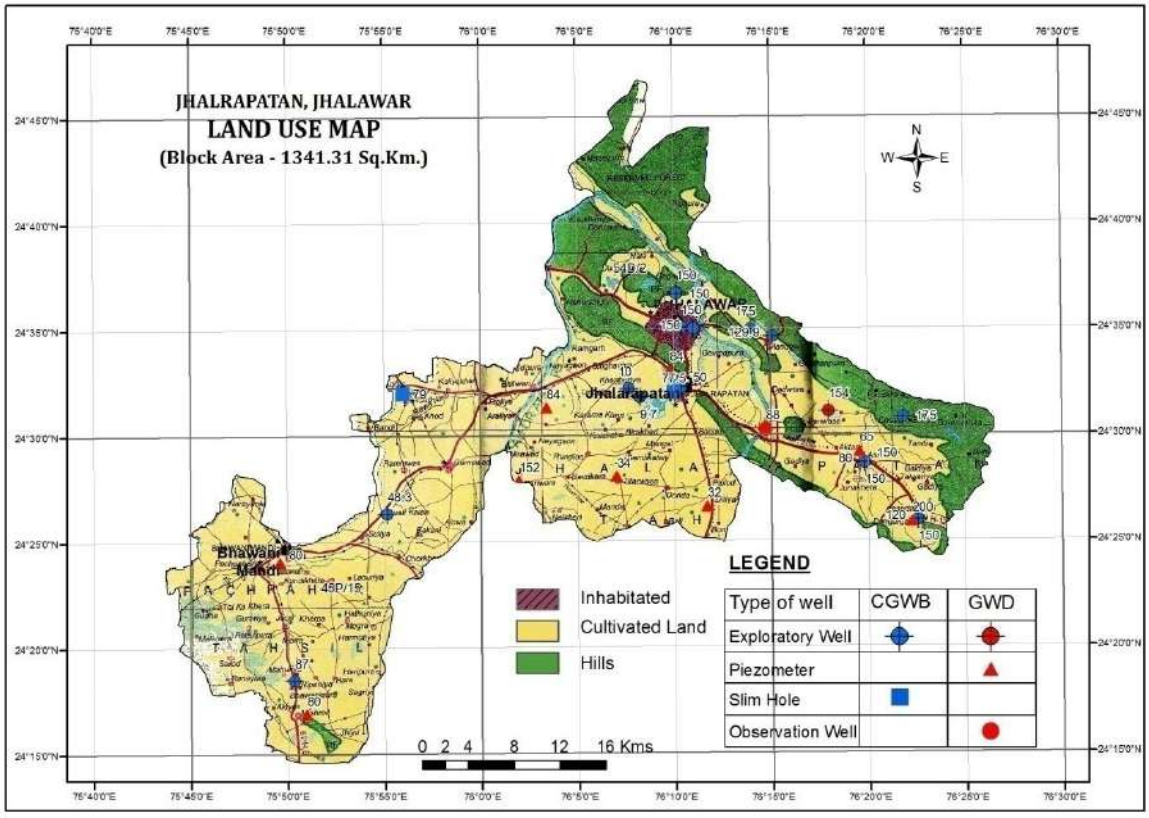


Fig. 50 : Map showing Land Use.

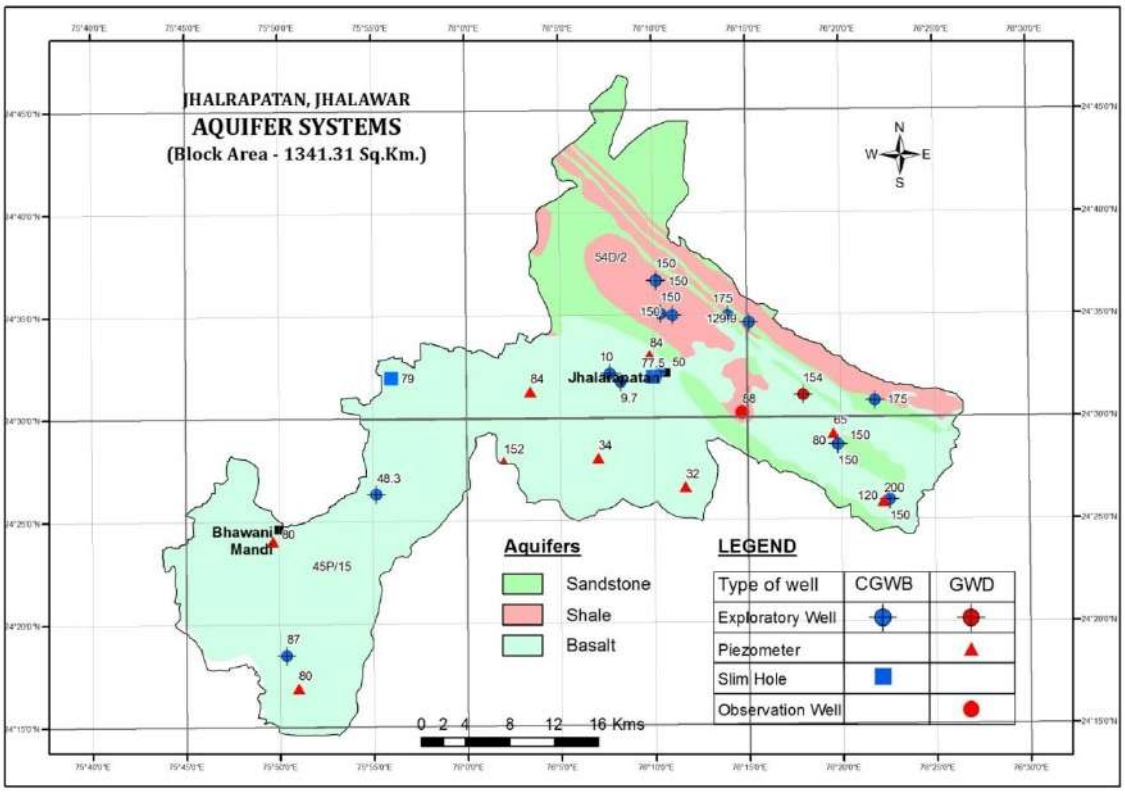
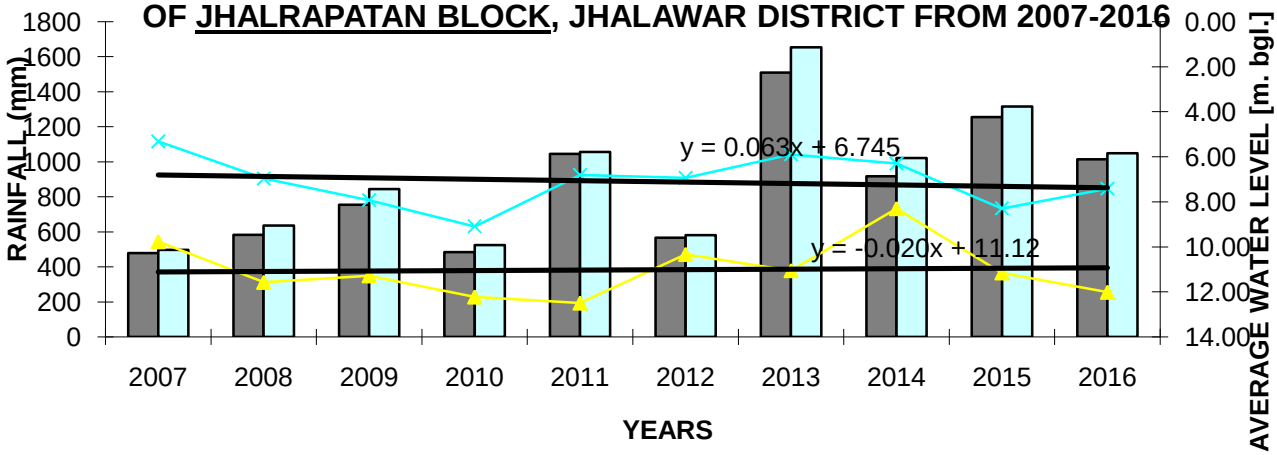


Fig.51 : Map showing Principal Aquifer.

FIG. 52 HYDROGRAPH OF PRE AND POST MONSOON WATER LEVELS AND BAR DIAGRAM OF MONSOON AND ANNUAL RAINFALL OF JHALRAPATAN BLOCK, JHALAWAR DISTRICT FROM 2007-2016



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:

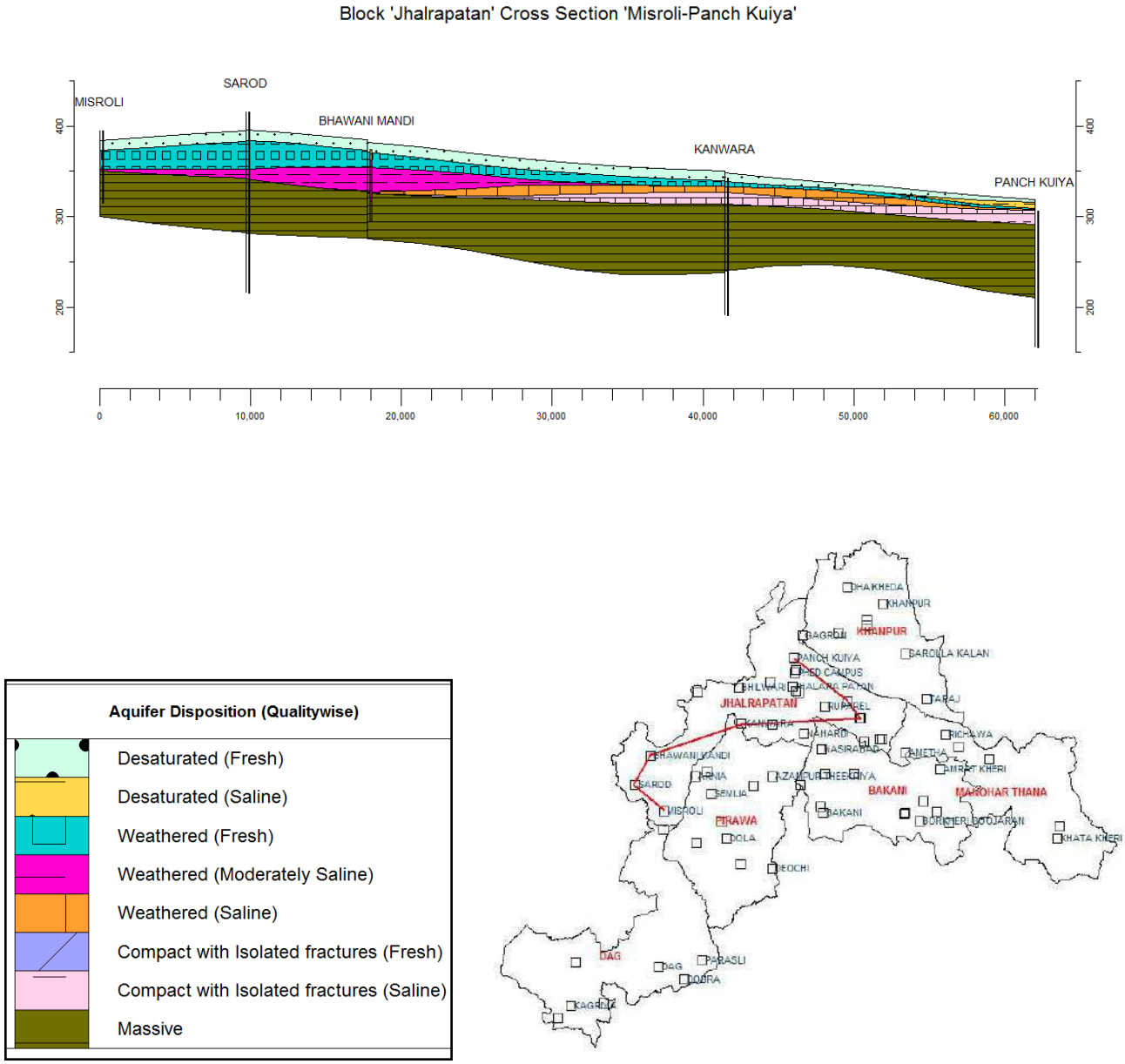


Fig.53 :Map showing aquifer disposition.

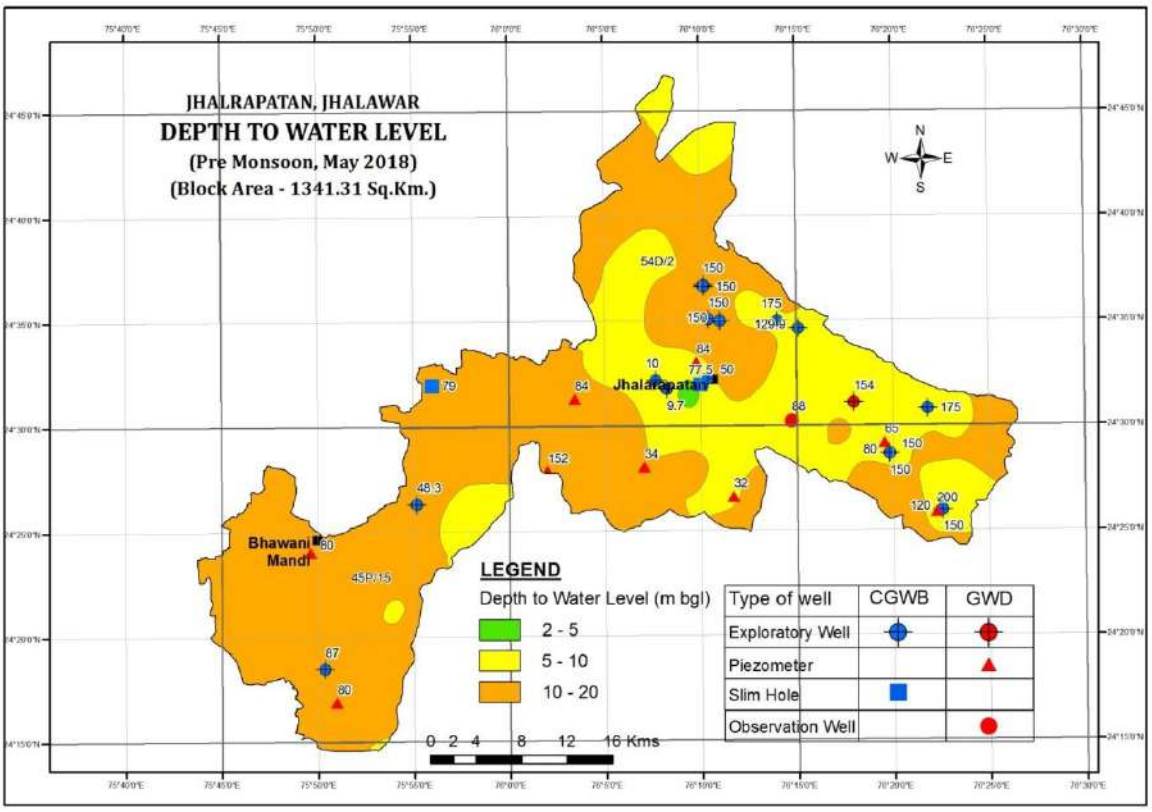


Fig.54 : Depth to Water Level (Pre Monsoon - May 2018)

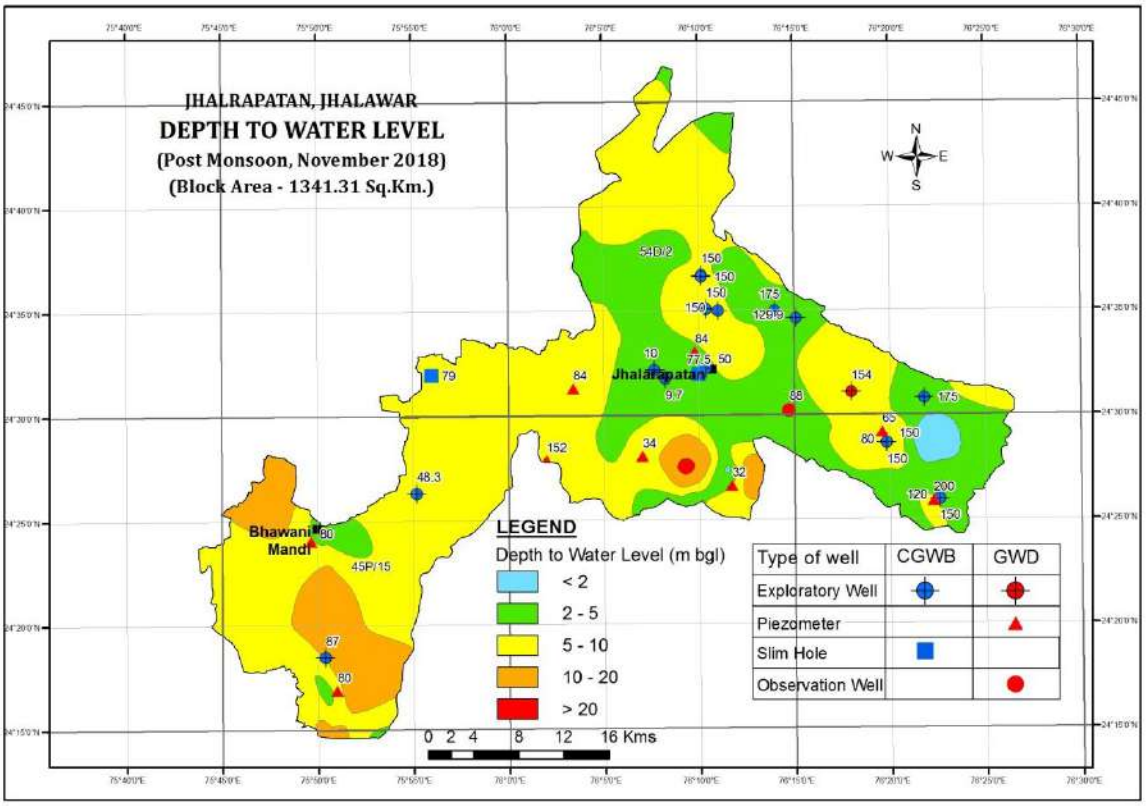


Fig.55 : Depth to Water Level (Post Monsoon - November, 2018)

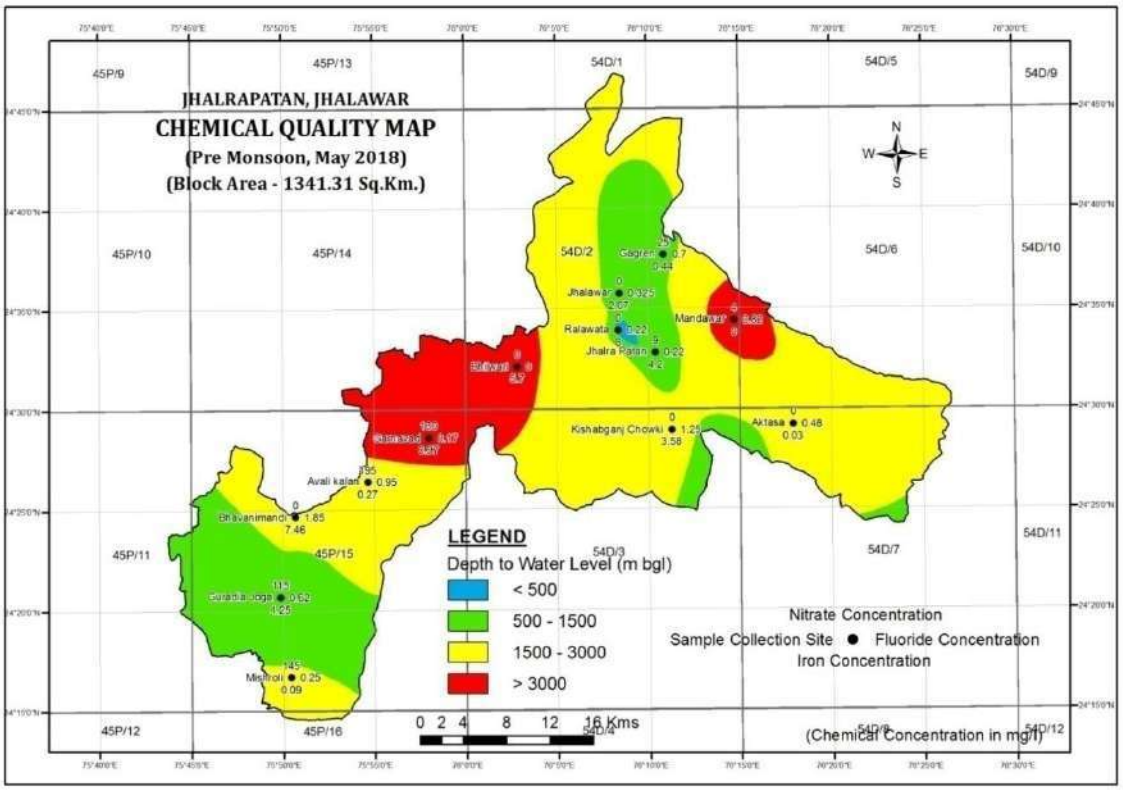


Fig.56:Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

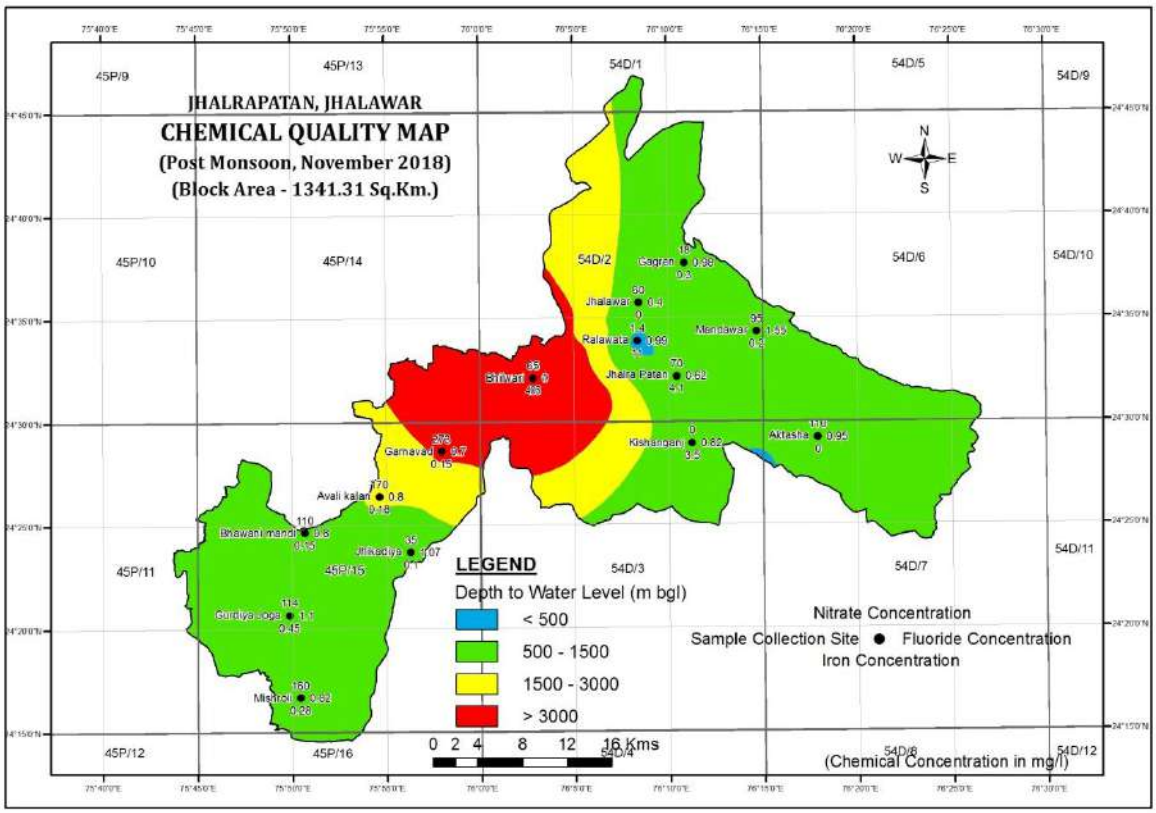


Fig.57: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

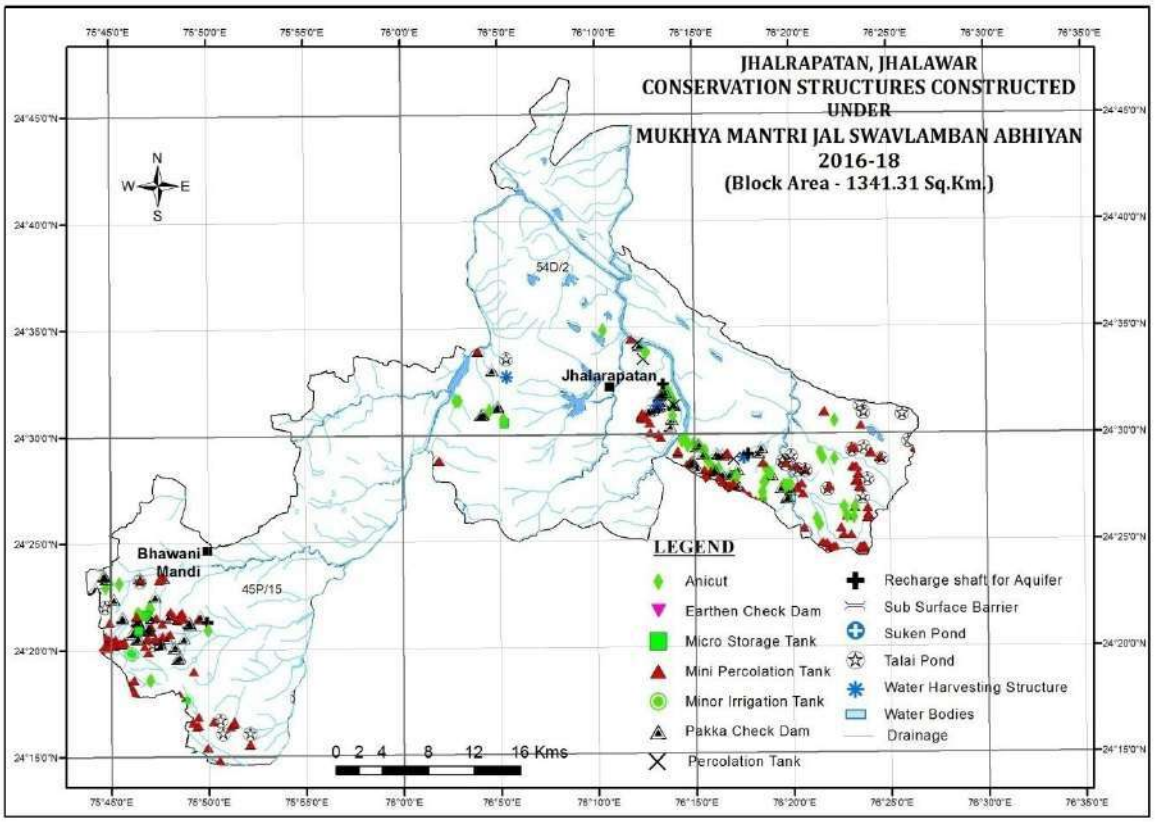


Fig.58 : Map showing locations of different type of recharge structures constructed under MJSA.

Salient Information	**Block**	**Jhalrapatan**
	Geographical Area (km2)	1341.31
	Forest Area (Sq.km)	41.69
	Potential Area (Sq.km)	1299.62
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2016)	954.2 m
Ground Water Issues	Aquifer Characteristics	Basalt & Sandstone/Shale, Unconfined aquifers
	Main Aquifers in the area	Occupied by Hard rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by Basalt & Sandstone/Shale
	Geology	Basalt & Sandstone/Shale
	Maximum Depth of Aquifer in meter	45
	Type of Aquifer	Unconfined aquifer
	Thickness of Aquifer (Utilisable)	23.25
	Hydraulic Characters (sp.yield%):	0.04
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	10.55
	Trend (m/yr)	0.34
Ground Water Quality	General	1308.2
	Electrical Conductivity in microS/cm (Min/Max)	172.12
	Chloride in mg/ litre (Min/Max)	46
	Nitrate in mg/litre (Min/Max)	0.39
	Fluoride in mg/litre (Min/Max)	
Groundwater Resources	Total annual ground water recharge(mcm)	118.2272
	Natural discharge during non-monsoon season(mcm)	11.8227
	Net ground water availability(mcm)	106.4045
	Existing gross ground water draft for irrigation(mcm)	101.1132
	Existing gross ground water draft for domestic & industrial uses(mcm)	3.4366
	Existing gross ground water draft for all uses(mcm)	104.5498
	Allocation for domestic & industrial requirement(mcm)	1.7885
	Net ground water availability for future irrigation development(mcm)	0.0000
	State of ground water development	98.26
	Category	Critical

Salient Supply Side Management	**Block**	**Jhalrapatan**
	Potenital Zone area (sq. km.)	1299.62
	Volume of sub surface storage space available for artificial recharge (mcm)	118.27
	Surplus available as per Tahal Report (in mcm)	213.65
	No. of RS (0.03 MCM/RS)	7121.82
	No of RS possible in block (as per water bodies)	600.00
	25% of Remaining Surplus water for Recharge and Conservation	48.91
	Surplus for Farm pond (0.0027 MCM)	48.91
	No of Farm Pond	18116
Expected Benefits	Net G.W. Availability (mcm)	106.40
	Additional Recharge from RWH & conservation (mcm)	42.46
	Total Net G.W. Availability after intervention (mcm)	148.86
	Existing G.W Draft for all purpose (mcm)	104.55
	Net GW draft after interventions (mcm)	104.55
	Present stage of G.W. development (%)	98.26
	Projected stage of G.W. Dev. (in %)	70.23
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

(d) **Khanpur :** The Khanpur block is surrounded by the state of Madhya Pradesh & Baran district of Rajasthan state in the East & North, South & west by Manohar thana & Jhalrapatan blocks respectively.

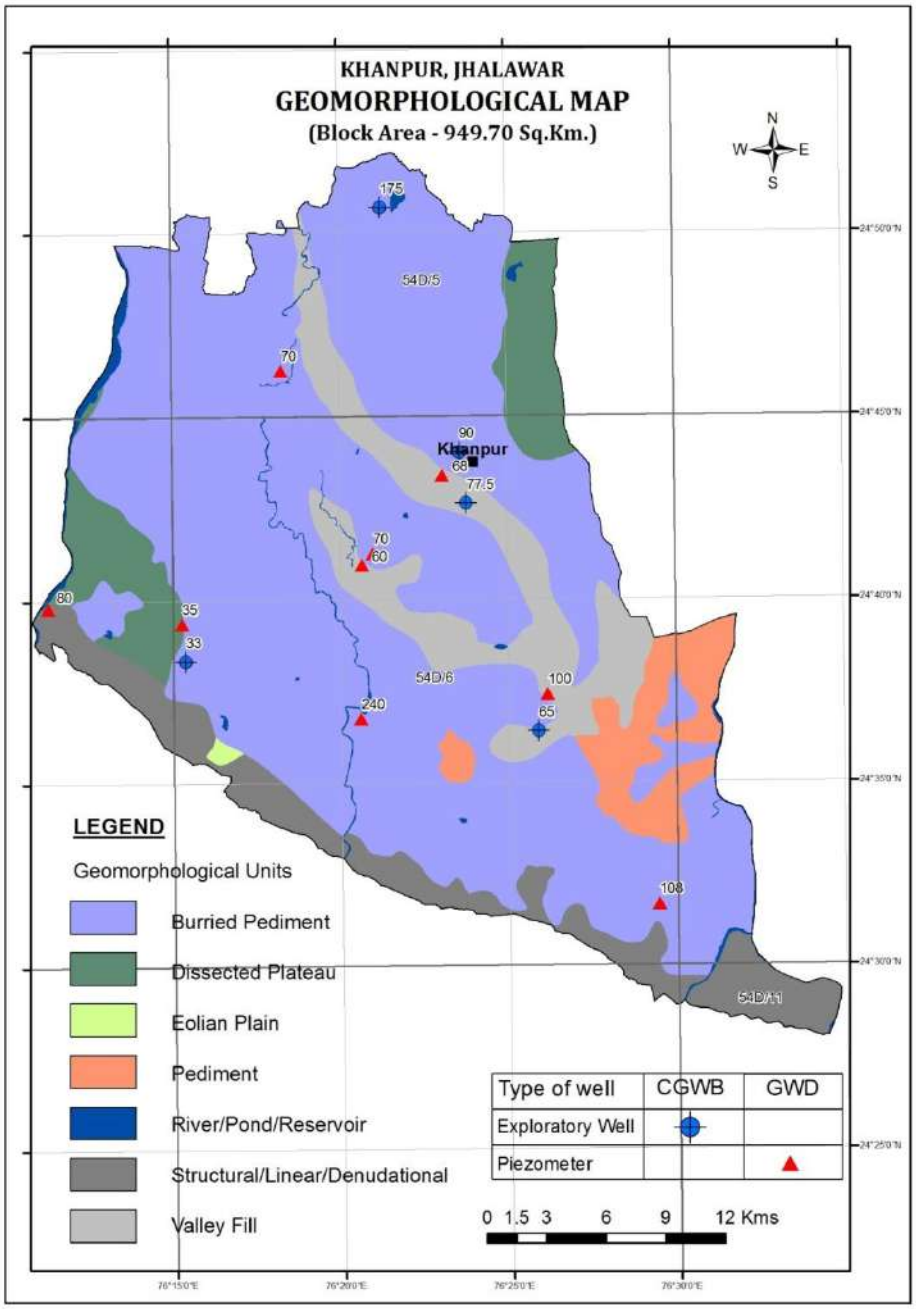


Fig.59 : Map showing Physiography & Drainage.

Fig. 60 : Map showing Land Use.

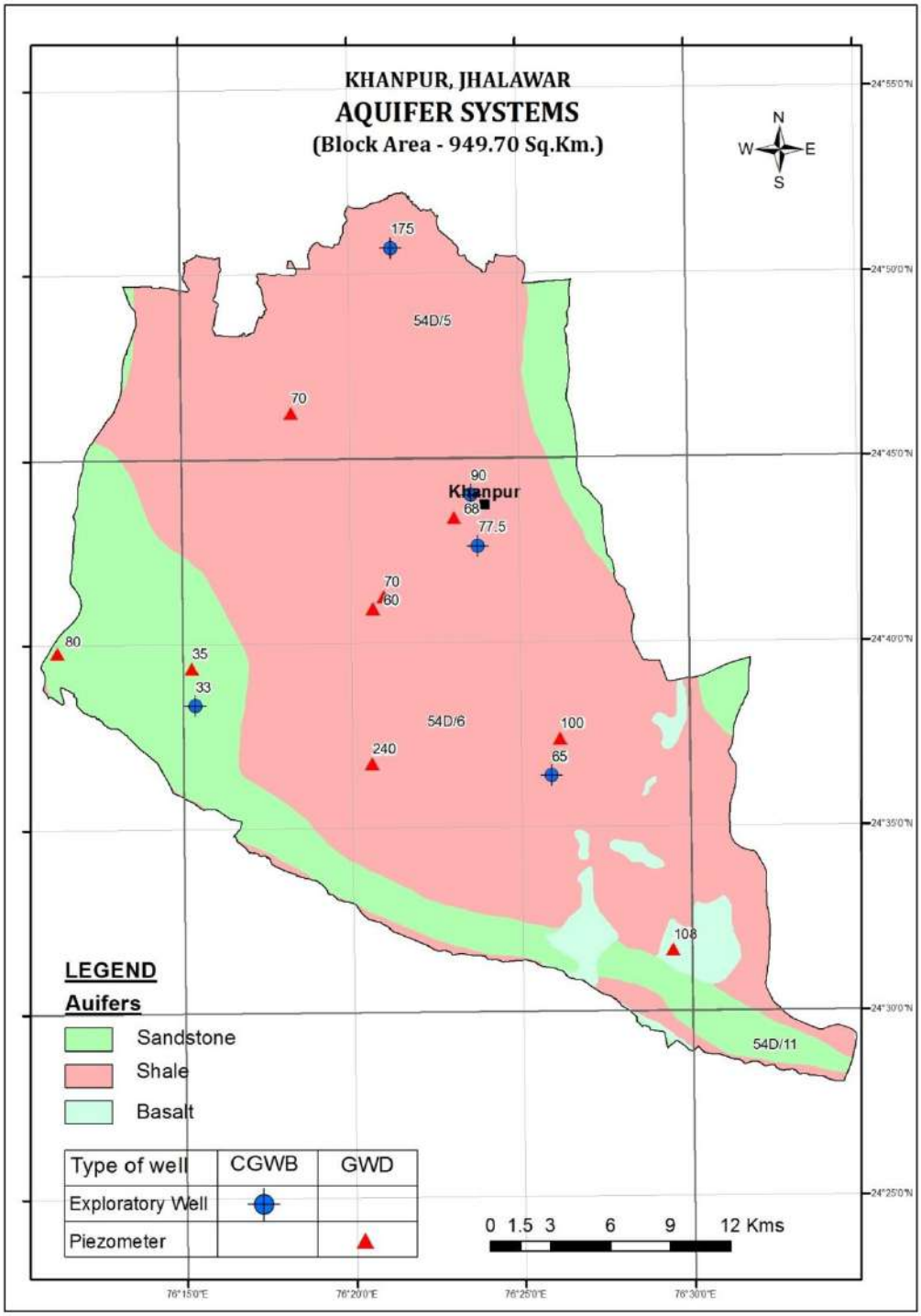
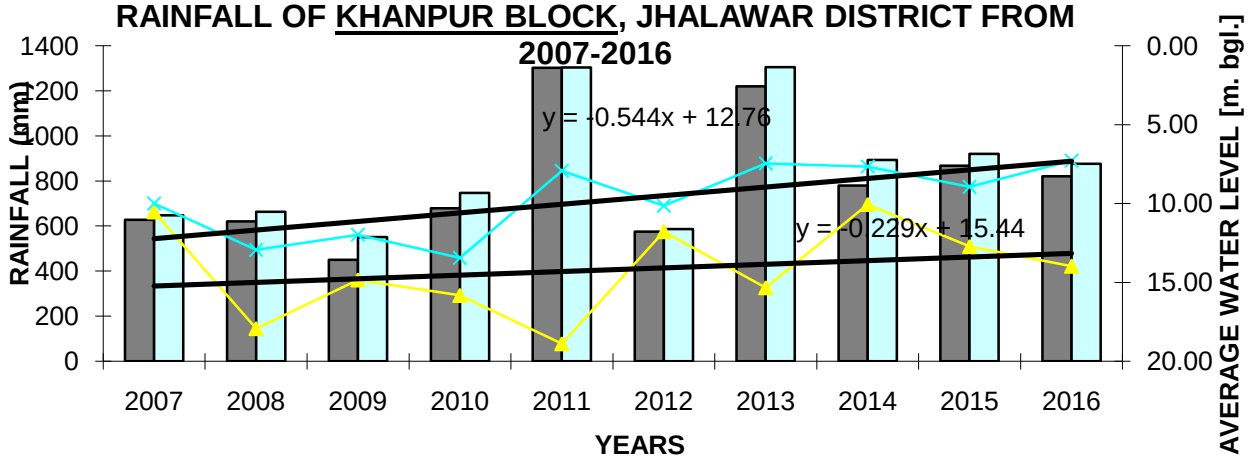


Fig.61 : Map showing Principal Aquifer.

FIG. 62 HYDROGRAPH OF PRE AND POST MONSOON WATER LEVELS AND BAR DIAGRAM OF MONSOON AND ANNUAL RAINFALL OF KHANPUR BLOCK, JHALAWAR DISTRICT FROM 2007-2016



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:

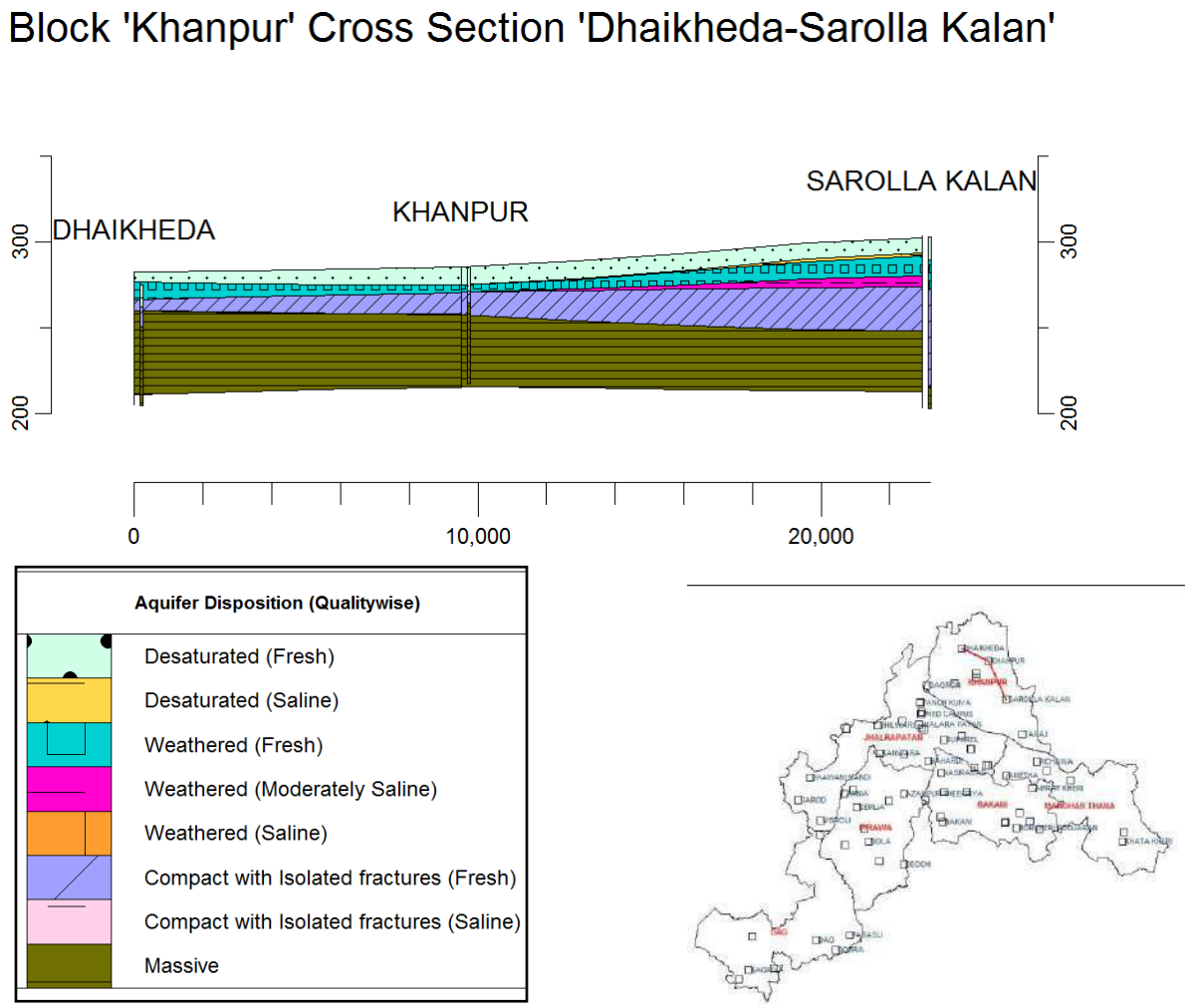


Fig.63 :Map showing aquifer disposition.

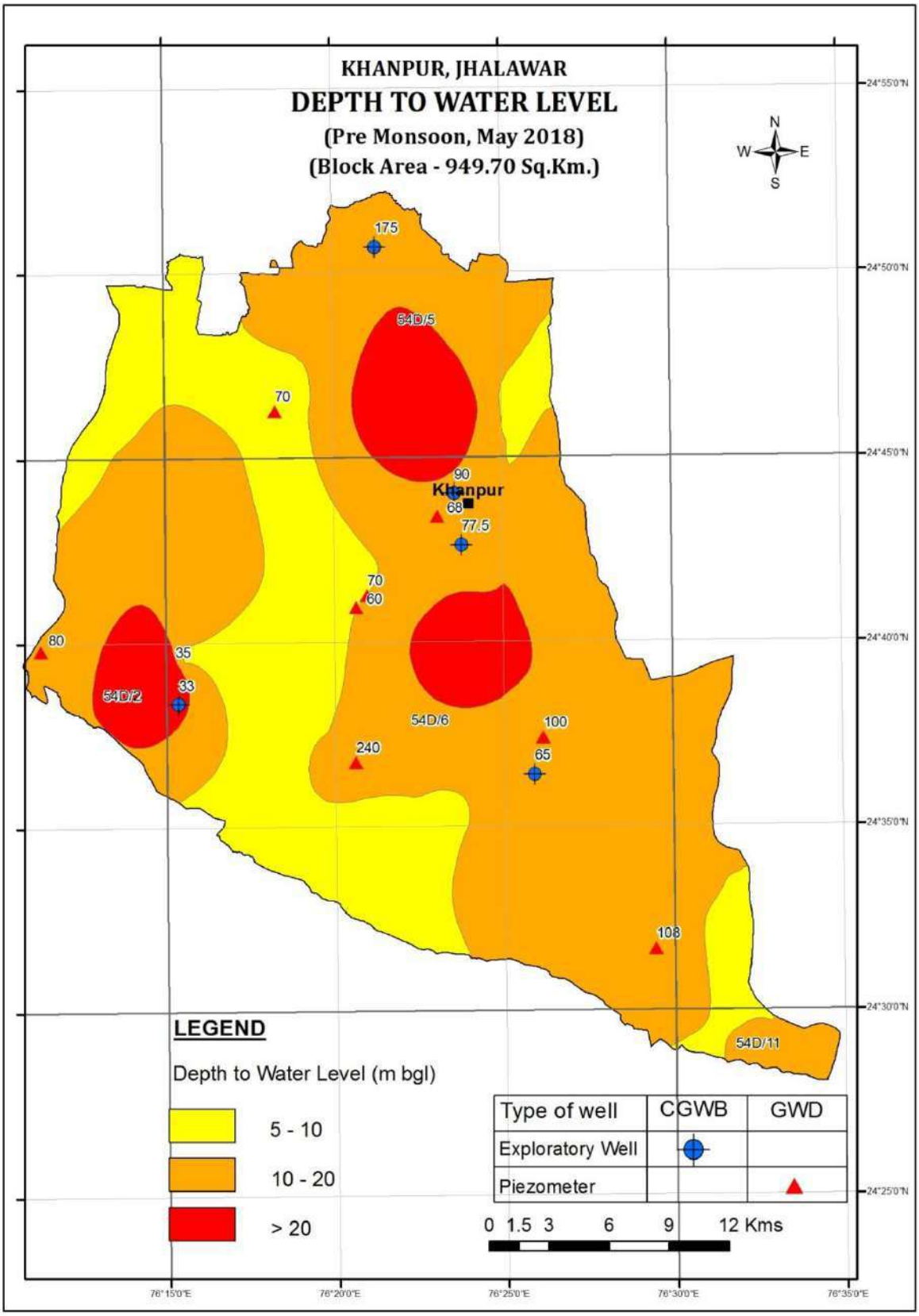


Fig.64 : Depth to Water Level (Pre Monsoon - May 2018)

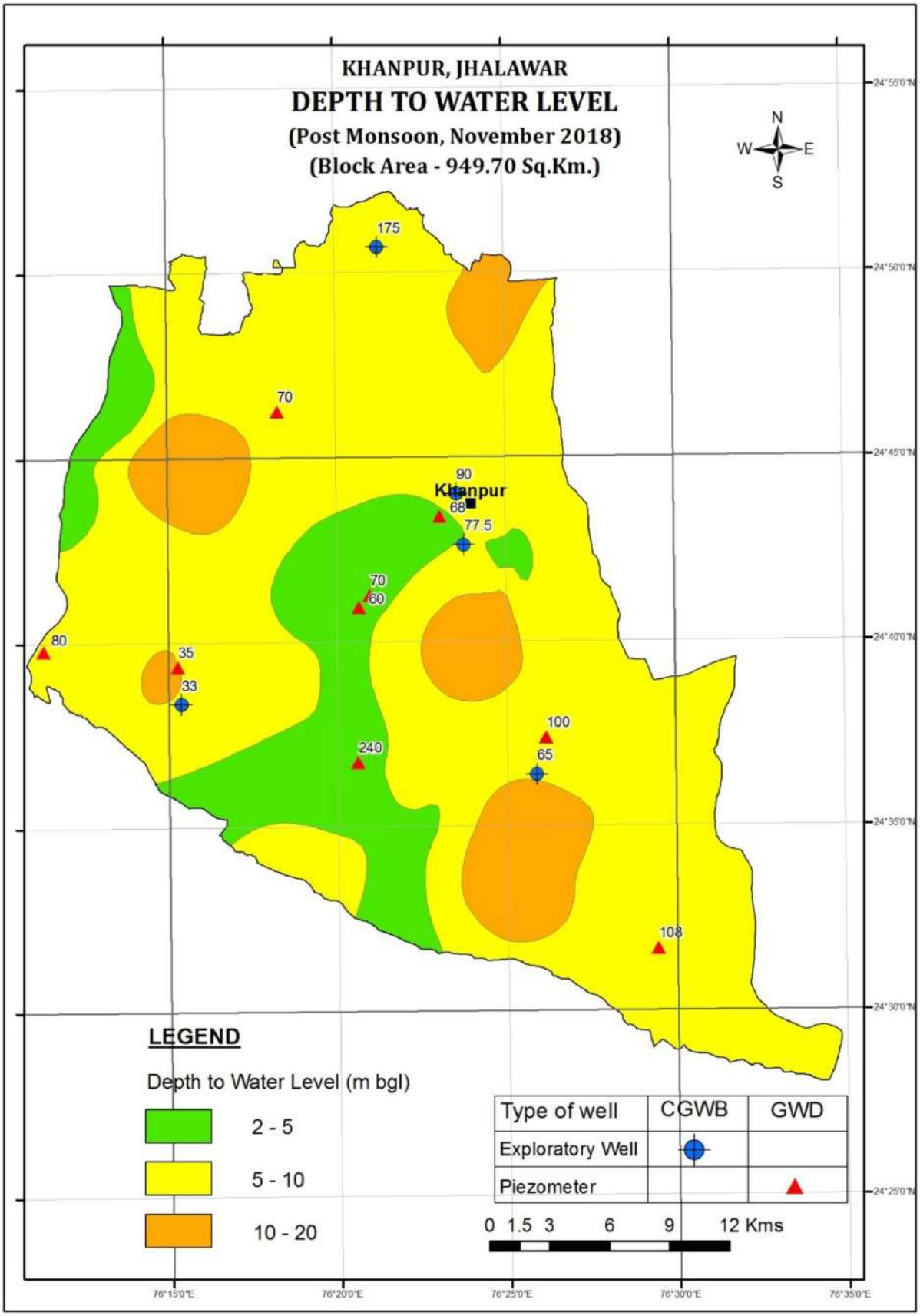


Fig.65 : Depth to Water Level (Post Monsoon - November, 2018)

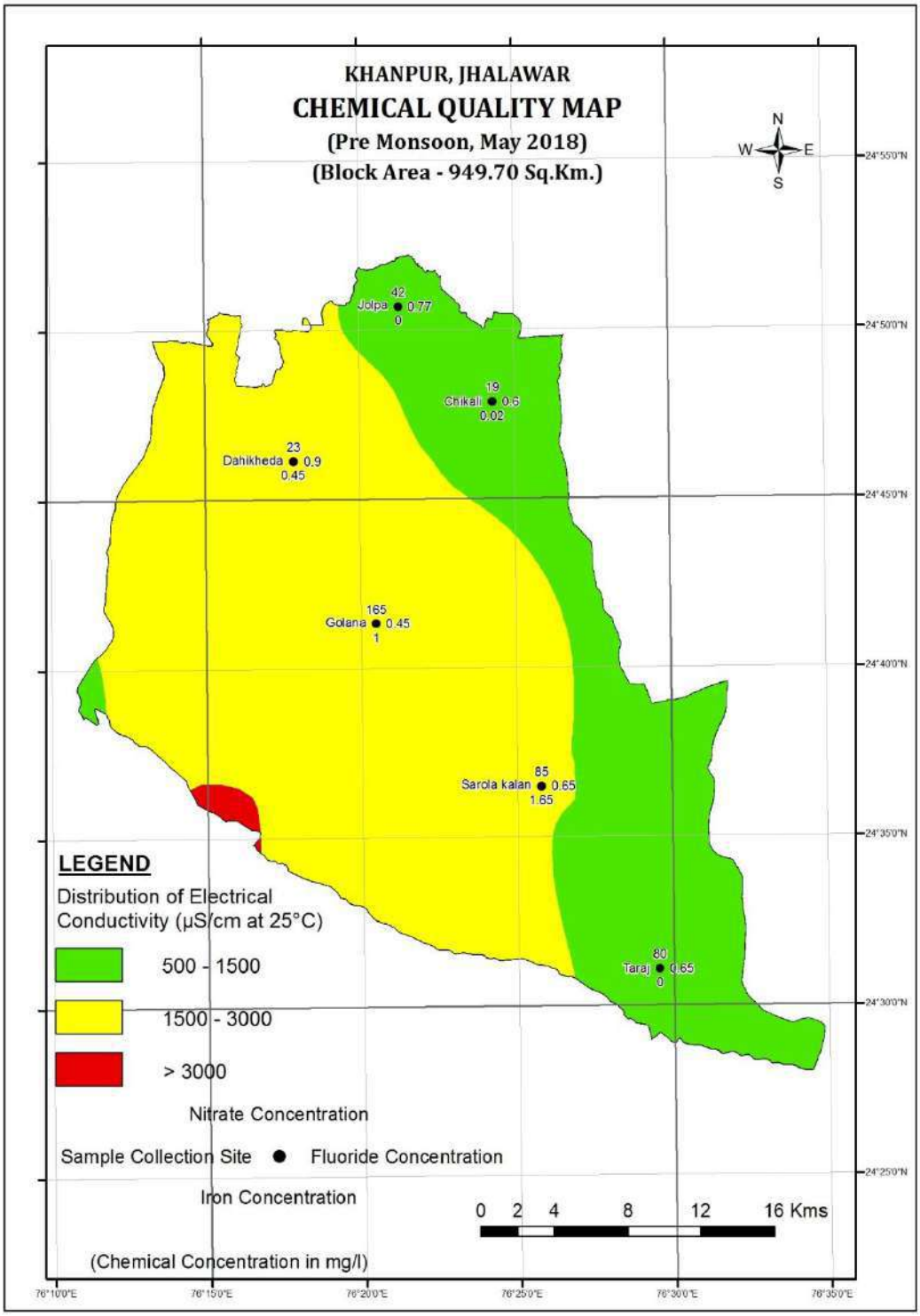


Fig.66: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

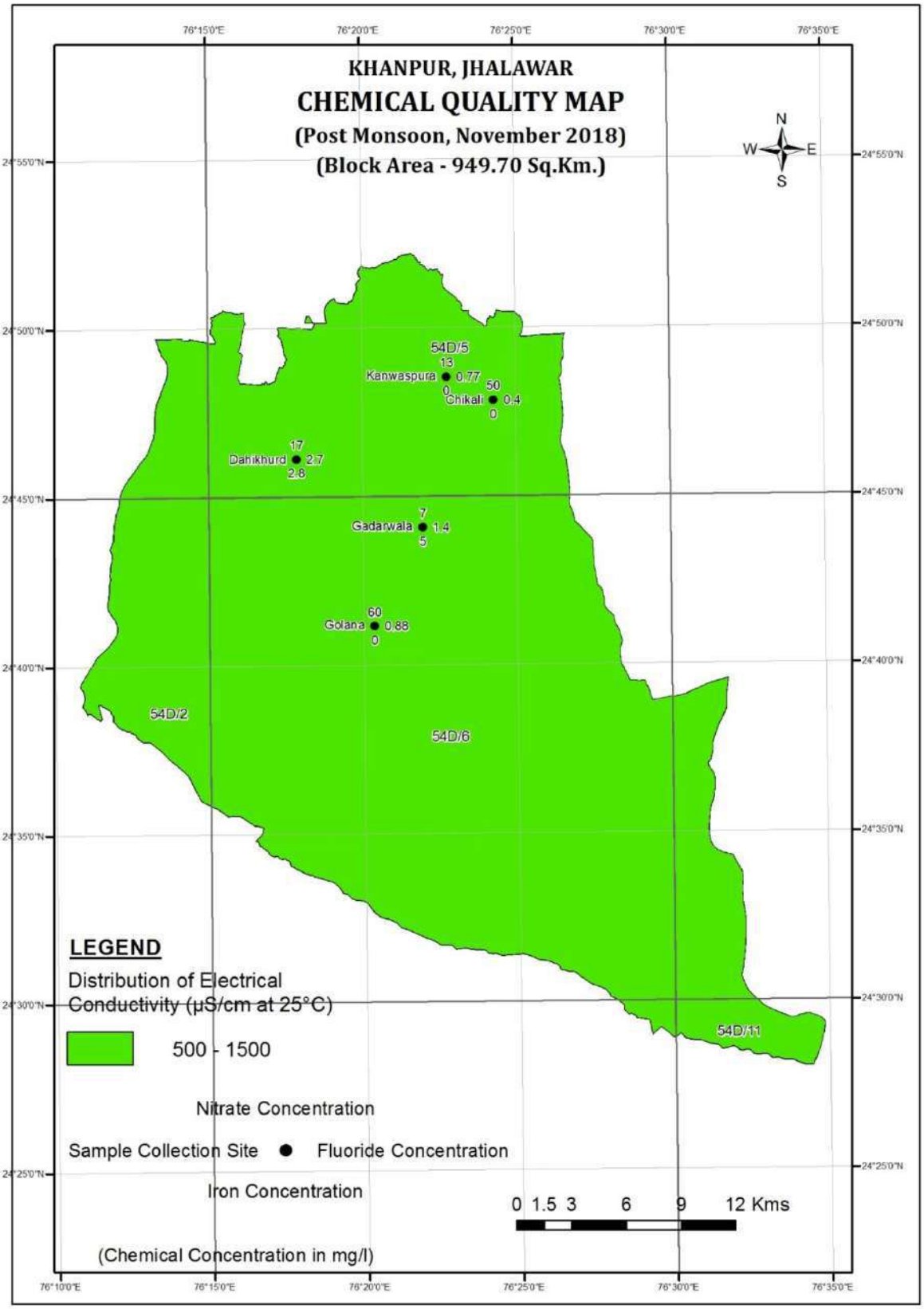


Fig.67: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

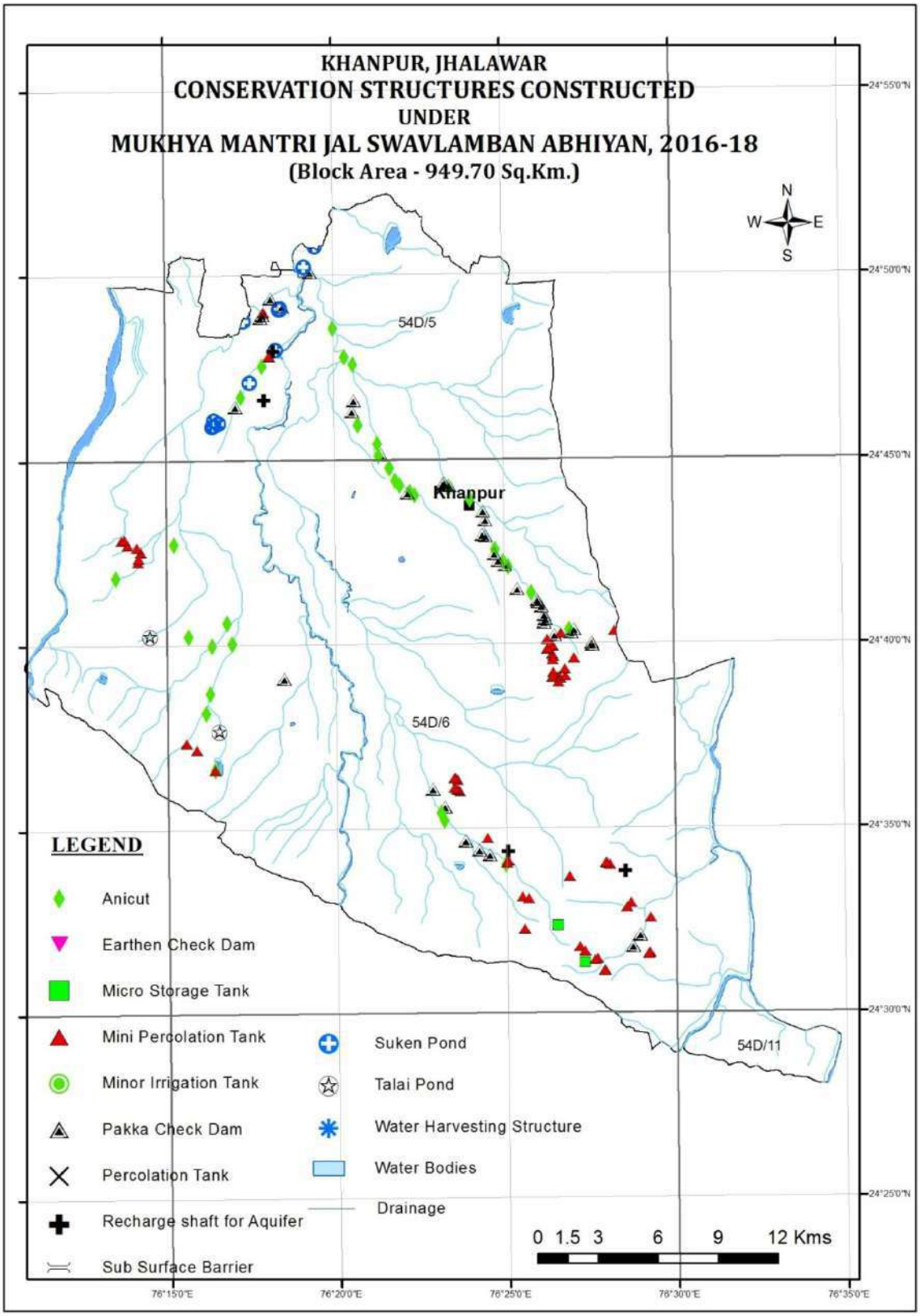


Fig. 68 : Map showing locations of different type of recharge structures constructed under MJSA.

Management Plan of Khanpur Block

Salient Information	**Block**	**Khanpur**
	Geographical Area (km2)	949.70
	Forest Area (Sq.km)	16.8
	Potential Area (Sq.km)	932.90
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2016)	847.3 mm
Ground Water Issues	Aquifer Characteristics	Sandstone/Shale, Unconfined aquifer
	Main Aquifers in the area	Occupied by Hard rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by Sandstone/Shale
	Geology	Sandstone/Shale
	Maximum Depth of Aquifer in meter	35
	Type of Aquifer	Unconfined Aquifer
	Thickness of Aquifer (Utilisable)	18.5
	Hydraulic Characters (sp.yield%)	0.015
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	12.56
	Trend (m/yr)	0.89
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1308.2
	Chloride in mg/ litre (Min/Max)	172.12
	Nitrate in mg/litre (Min/Max)	46
	Fluoride in mg/litre (Min/Max)	0.39
Groundwater Resources	Total annual ground water recharge(mcm)	111.3607
	Natural discharge during non-monsoon season(mcm)	28.3302
	Net ground water availability(mcm)	83.0305
	Existing gross ground water draft for irrigation(mcm)	88.2351
	Existing gross ground water draft for domestic & industrial uses(mcm)	2.7925
	Existing gross ground water draft for all uses(mcm)	91.0276
	Allocation for domestic & industrial requirement(mcm)	5.3565
	Net ground water availability for future irrigation development(mcm)	2.8891
	State of ground water development	109.63
	Category	Over-Exploited

Salient Supply Side Management	Block	Khanpur
	Potenital Zone area (sq. km.)	932.90
	Volume of sub surface storage space available for artificial recharge (mcm)	115.87
	Surplus available as per Tahal Report (in mcm)	151.74
	No. of RS (0.03 MCM/RS)	5057.84
	No of RS possible in block (as per water bodies)	153.00
	25% of Remaining Surplus water for Recharge and Conservation	36.79
	Surplus for Farm pond (0.0027 MCM)	36.79
	No of Farm Pond	13625
Expected Benefits	Net G.W. Availability (mcm)	83.03
	Additional Recharge from RWH & conservation (mcm)	22.98
	Total Net G.W. Availability after intervention (mcm)	106.01
	Existing G.W Draft for all purpose (mcm)	91.03
	Net GW draft after interventions (mcm)	91.03
	Present stage of G.W. development (%)	109.63
	Projected stage of G.W. Dev. (in %)	85.86
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

(e) **Manohar Thana :** The Manohar thana block is surrounded by the state of Madhya Pradesh towards north, south & east directions & NW & SW byKhanpur, Jhalrapatan, Bakani blocks of Jhalawar district respectively.

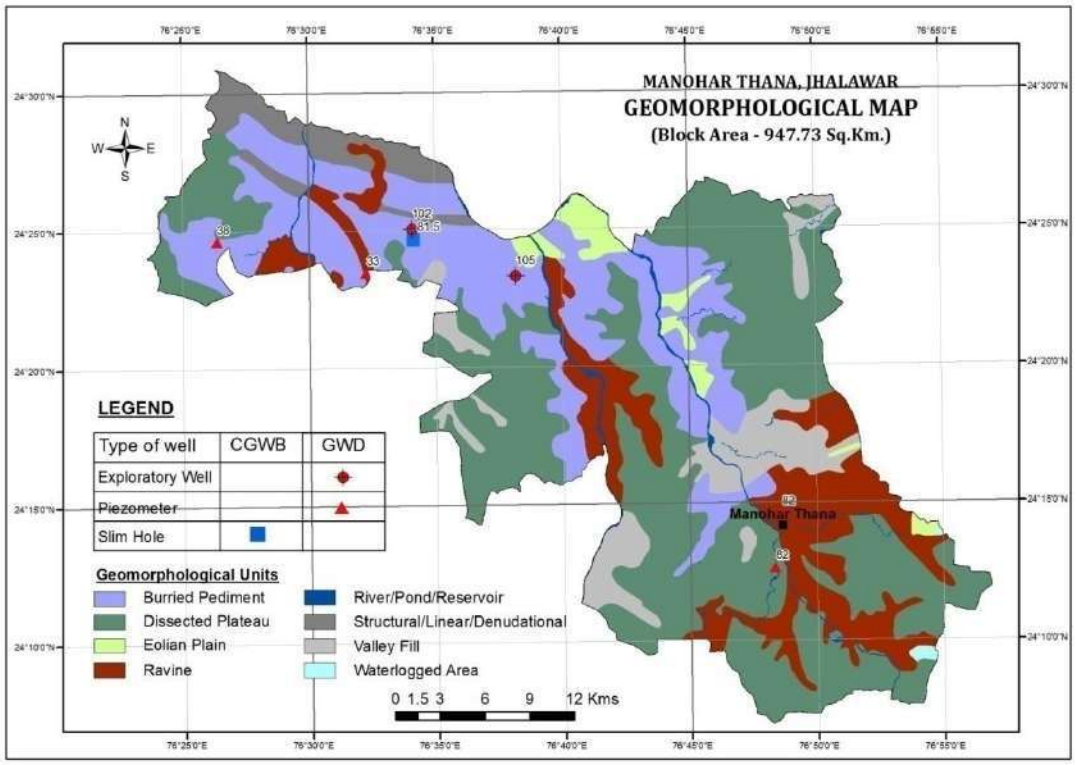


Fig. 69 : Map showing Physiography & Drainage.

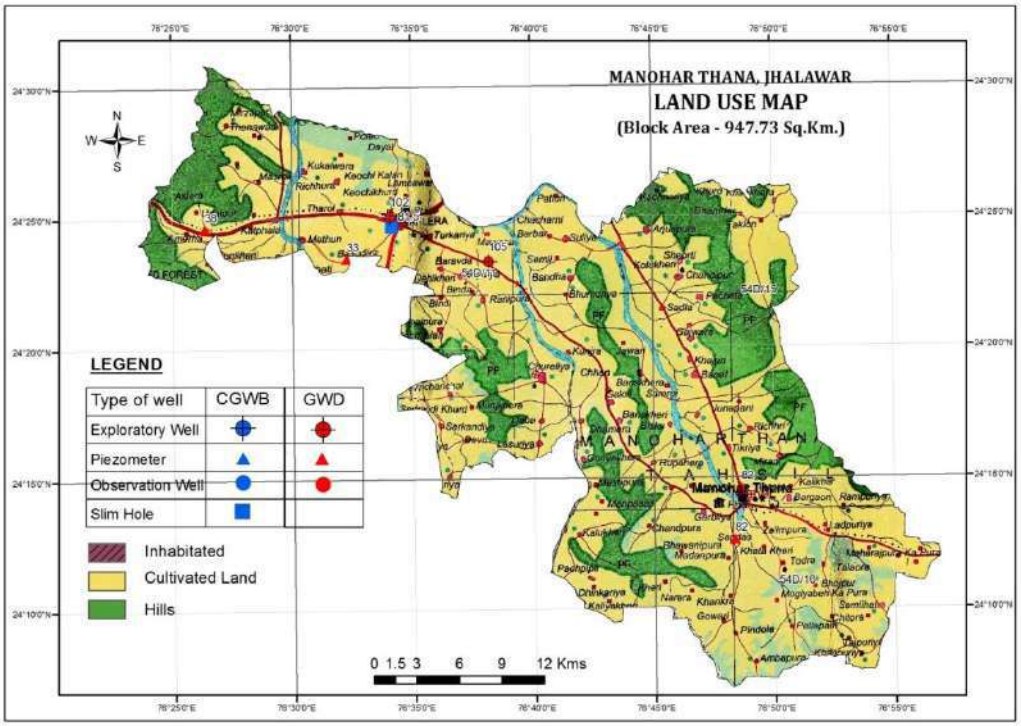


Fig. 70 : Map showing Land Use.

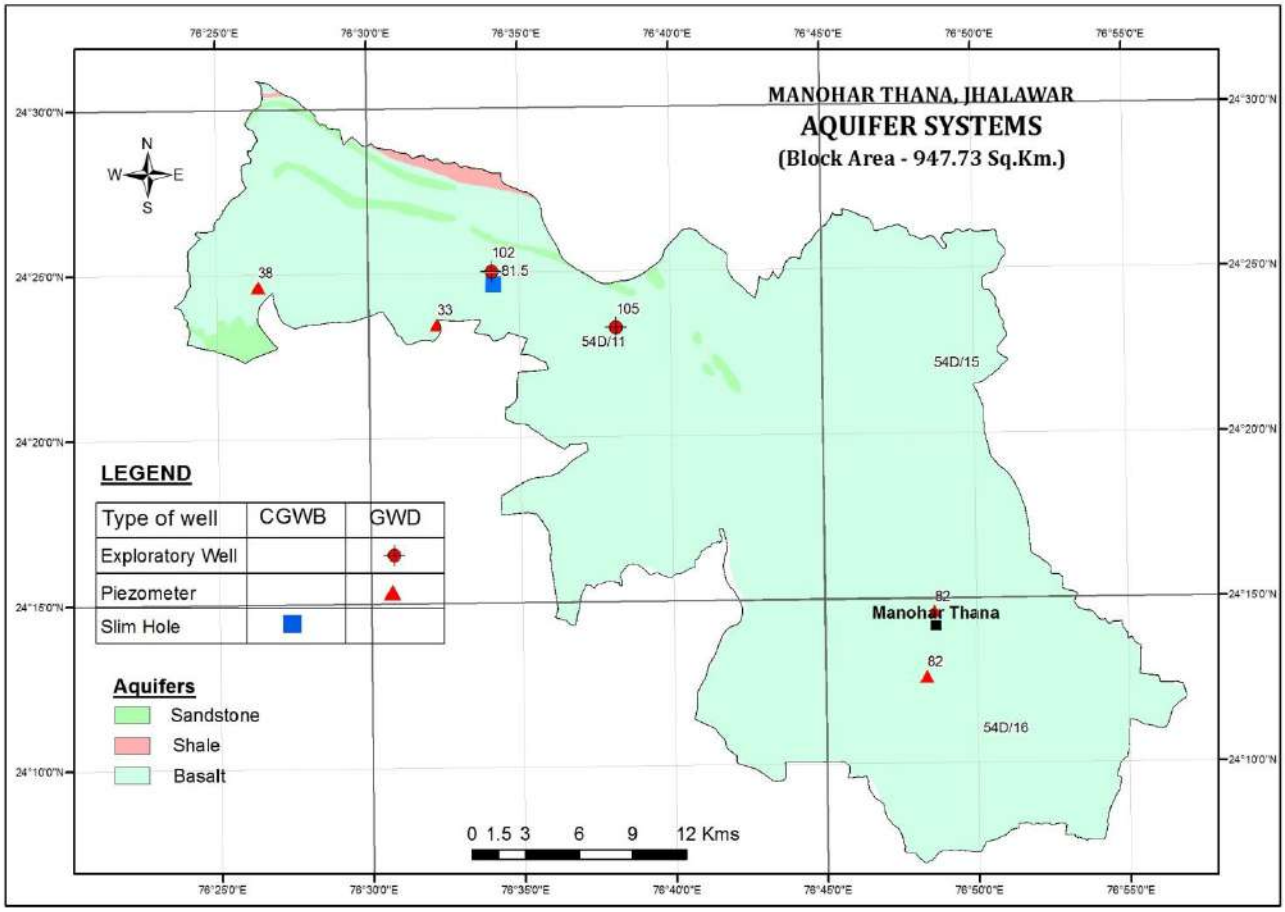
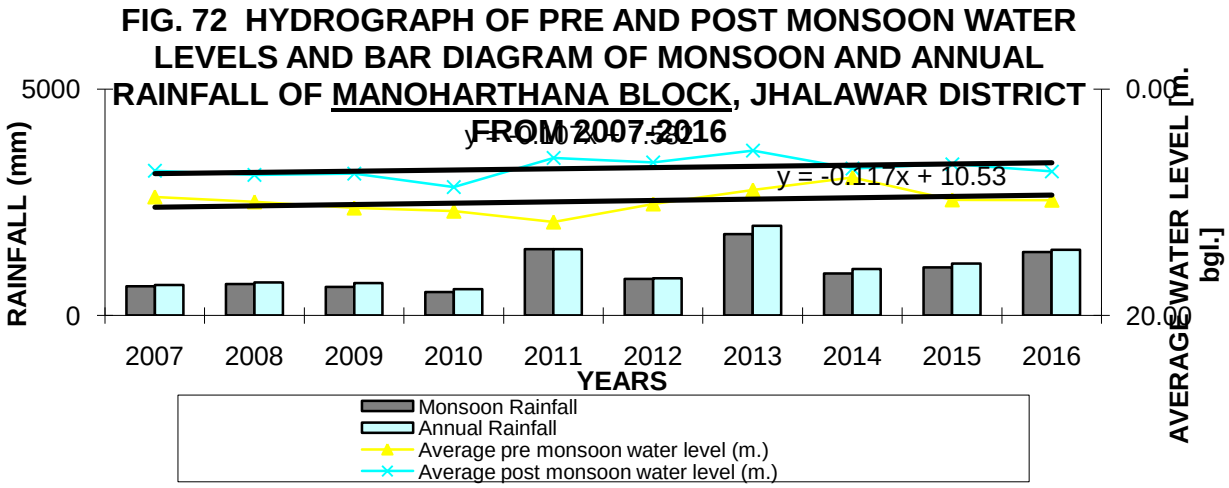
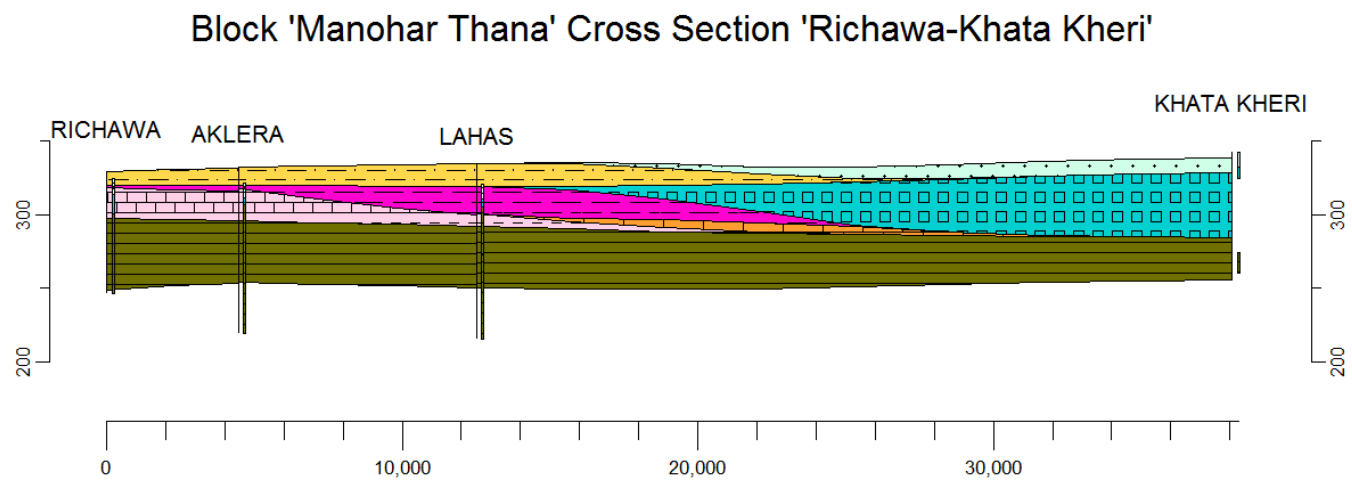


Fig.71 : Map showing Principal Aquifer.



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:



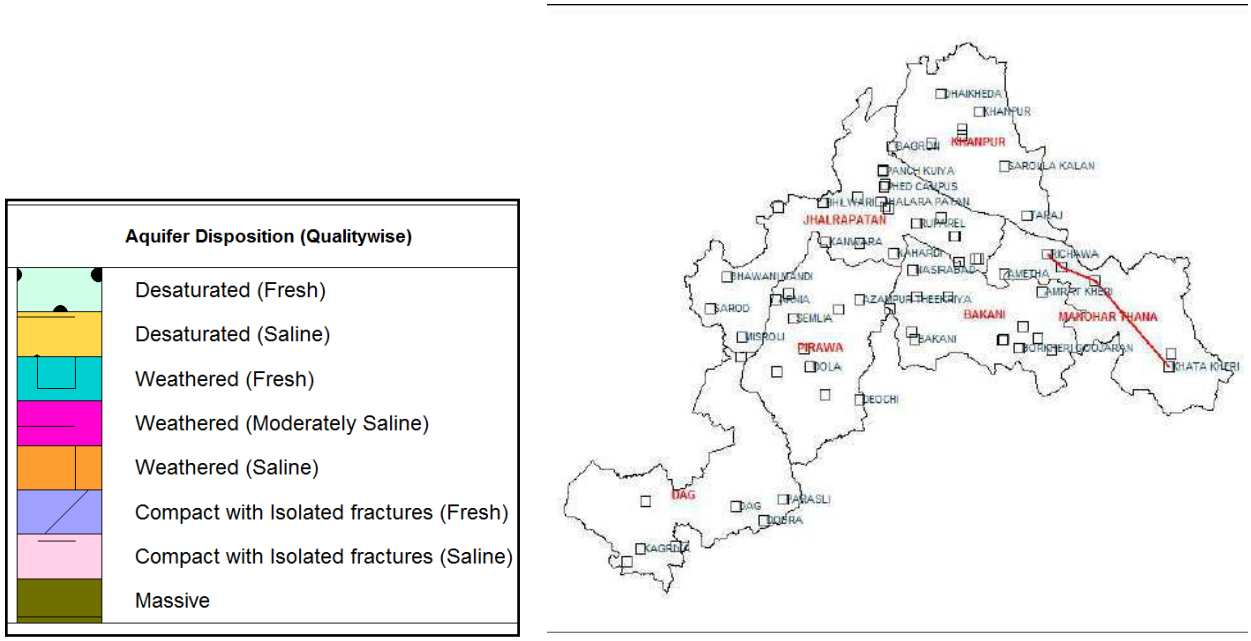


Fig.73 :Map showing aquifer disposition.

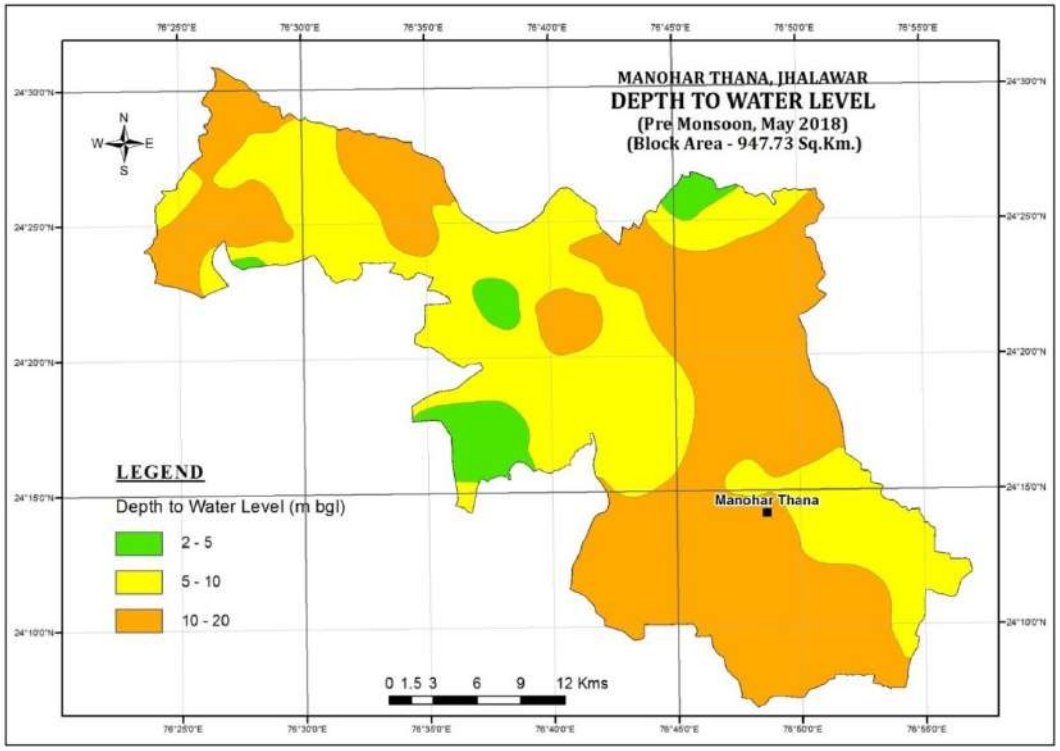


Fig.74 : Depth to Water Level (Pre Monsoon - May 2018)

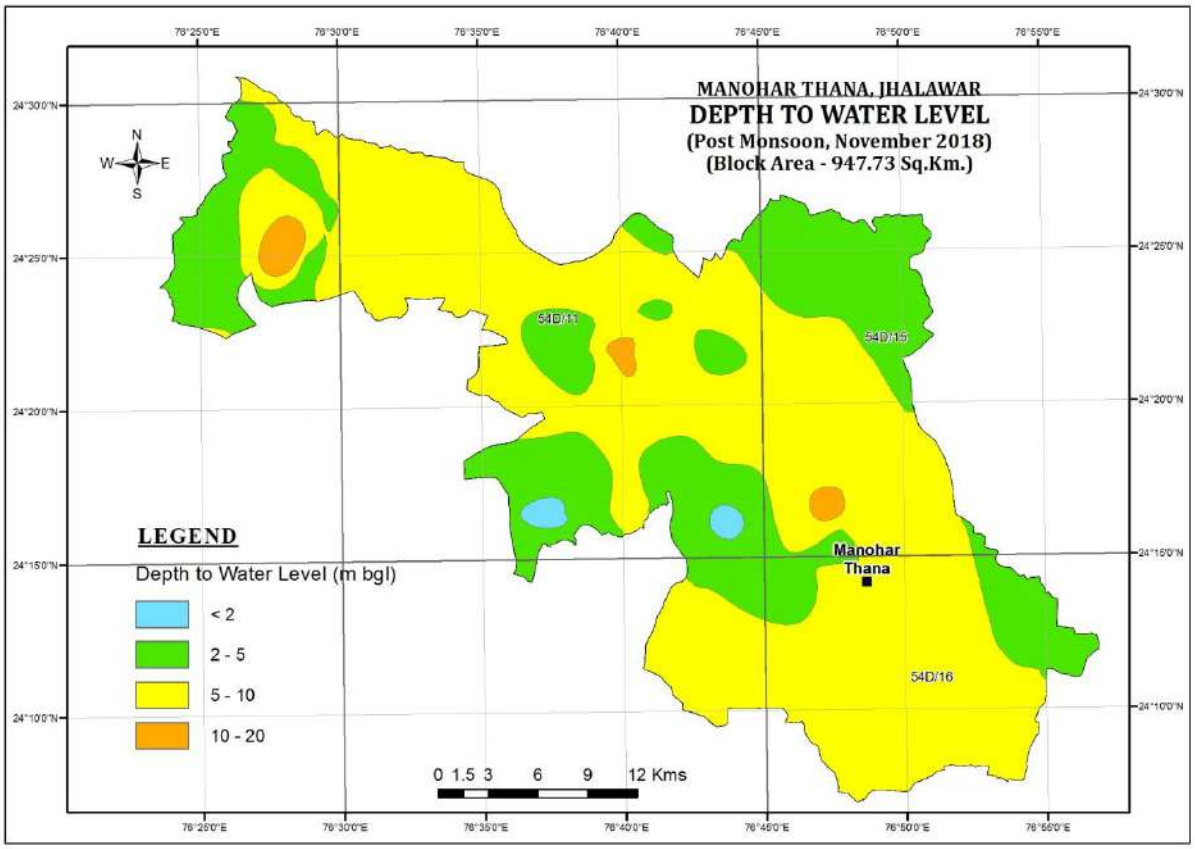


Fig.75 : Depth to Water Level (Post Monsoon - November, 2018)

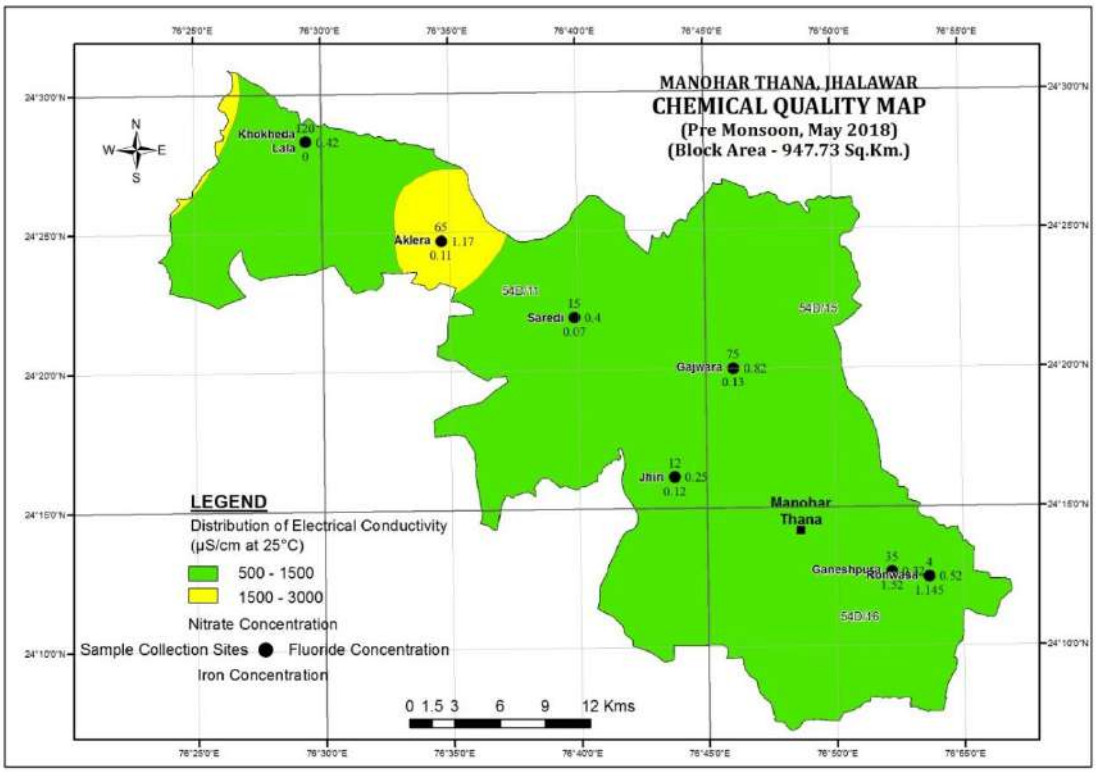


Fig.76: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

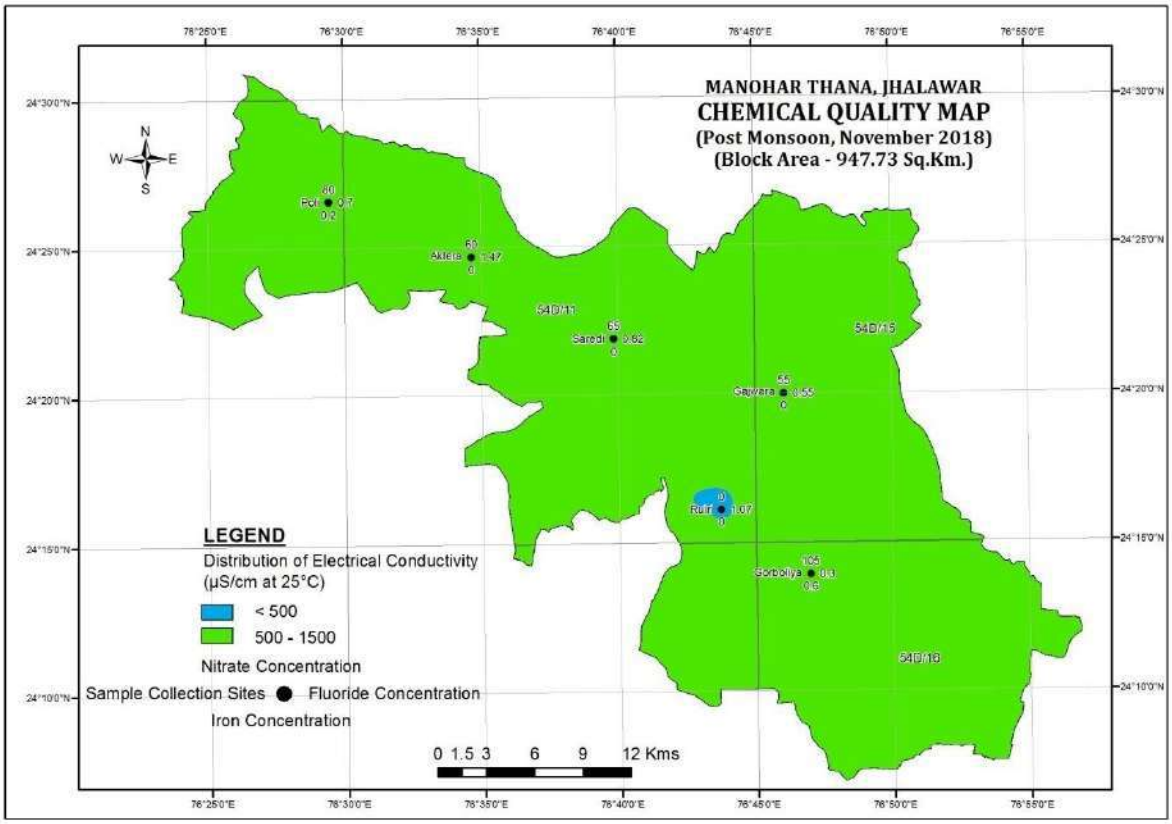


Fig.77: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

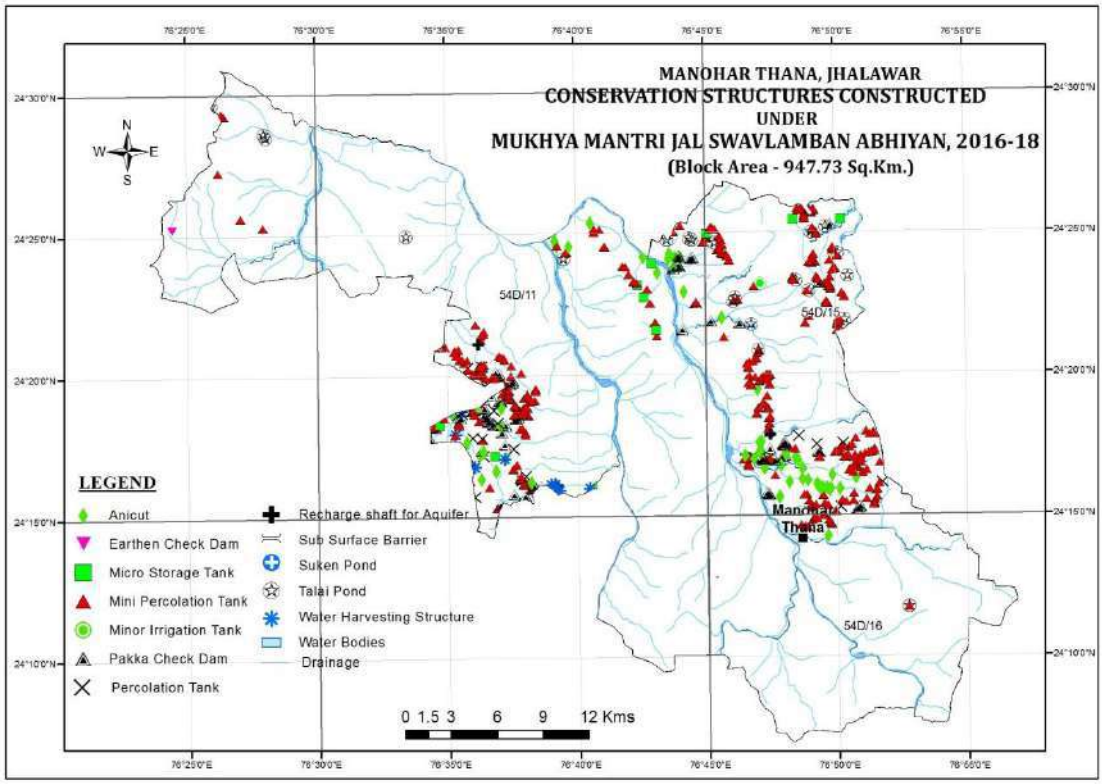


Fig. 78 : Map showing locations of different type of recharge structures constructed under MJSA.

Management Plan of Manohar Thana Block

Salient Information	**Block**	**Manohar Thana**
	Geographical Area (km2)	937.46
	Forest Area (Sq.km)	17.49
	Potential Area (Sq.km)	919.97
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2016)	1039.7 mm
Ground Water Issues	Aquifer Characteristics	Basalt, Unconfined Aquifer
	Main Aquifers in the area	Covered by Hard Rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by Basalt
	Geology	Basalt
	Maximum Depth of Aquifer in meter	32
	Type of Aquifer	Unconfined Aquifer
	Thickness of Aquifer (Utilisable)	18.5
	Hydraulic Characters (sp.yield%)	0.015
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	10.41
	Trend (m/yr)	0.19
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1308.2
	Chloride in mg/ litre (Min/Max)	172.12
	Nitrate in mg/litre (Min/Max)	46
	Fluoride in mg/litre (Min/Max)	0.39
Groundwater Resources	Total annual ground water recharge(mcm)	111.3310
	Natural discharge during non-monsoon season(mcm)	21.4546
	Net ground water availability(mcm)	89.8764
	Existing gross ground water draft for irrigation(mcm)	84.8130
	Existing gross ground water draft for domestic & industrial uses(mcm)	2.3691
	Existing gross ground water draft for all uses(mcm)	87.1821
	Allocation for domestic & industrial requirement(mcm)	5.7306
	Net ground water availability for future irrigation development(mcm)	6.7830
	State of ground water development	97
	Category	Critical

Salient	Block	Manohar Thana
Supply Side Management	Potenital Zone area (sq. km.)	919.97
	Volume of sub surface storage space available for artificial recharge (mcm)	58.79
	Surplus available as per Tahal Report (in mcm)	158.02
	No. of RS (0.03 MCM/RS)	5267.46
	No of RS possible in block (as per water bodies)	414.00
	25% of Remaining Surplus water for Recharge and Conservation	36.40
	Surplus for Farm pond (0.0027 MCM)	36.40
	No of Farm Pond	13482
Expected Benefits	Net G.W. Availability (mcm)	89.88
	Additional Recharge from RWH & conservation (mcm)	30.62
	Total Net G.W. Availability after intervention (mcm)	120.50
	Existing G.W Draft for all purpose (mcm)	87.18
	Net GW draft after interventions (mcm)	87.18
	Present stage of G.W. development (%)	97.00
	Projected stage of G.W. Dev. (in %)	72.35
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

(f) **Pirawa :** The Pirawa block is surrounded by the state of Madhya Pradesh towards South east and surrounded in West, north & east directions by Manohar thana, Khanpur, Jhalrapatan blocks of Jhalawar district respectively.

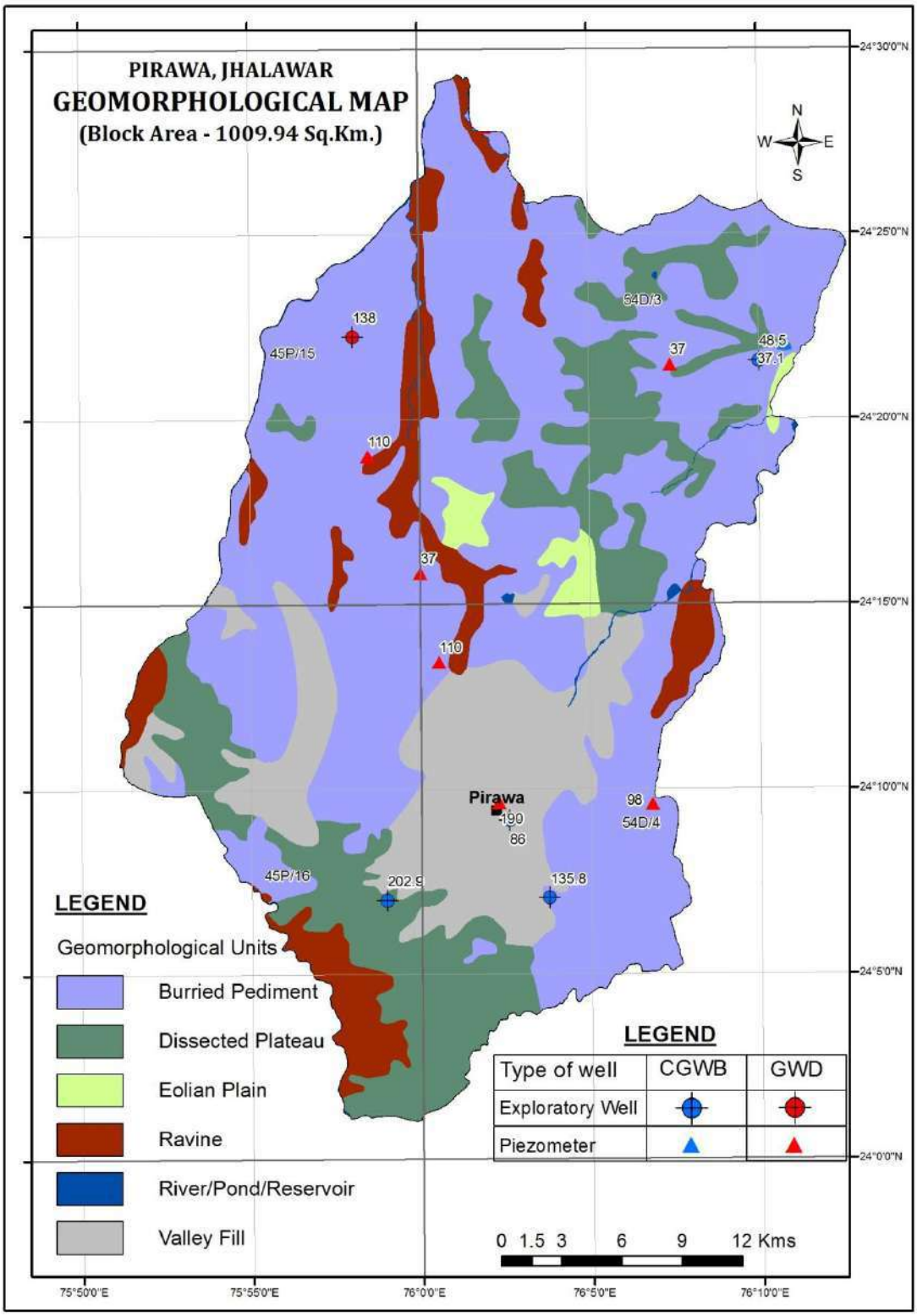


Fig. 79 : Map showing Physiography & Drainage.

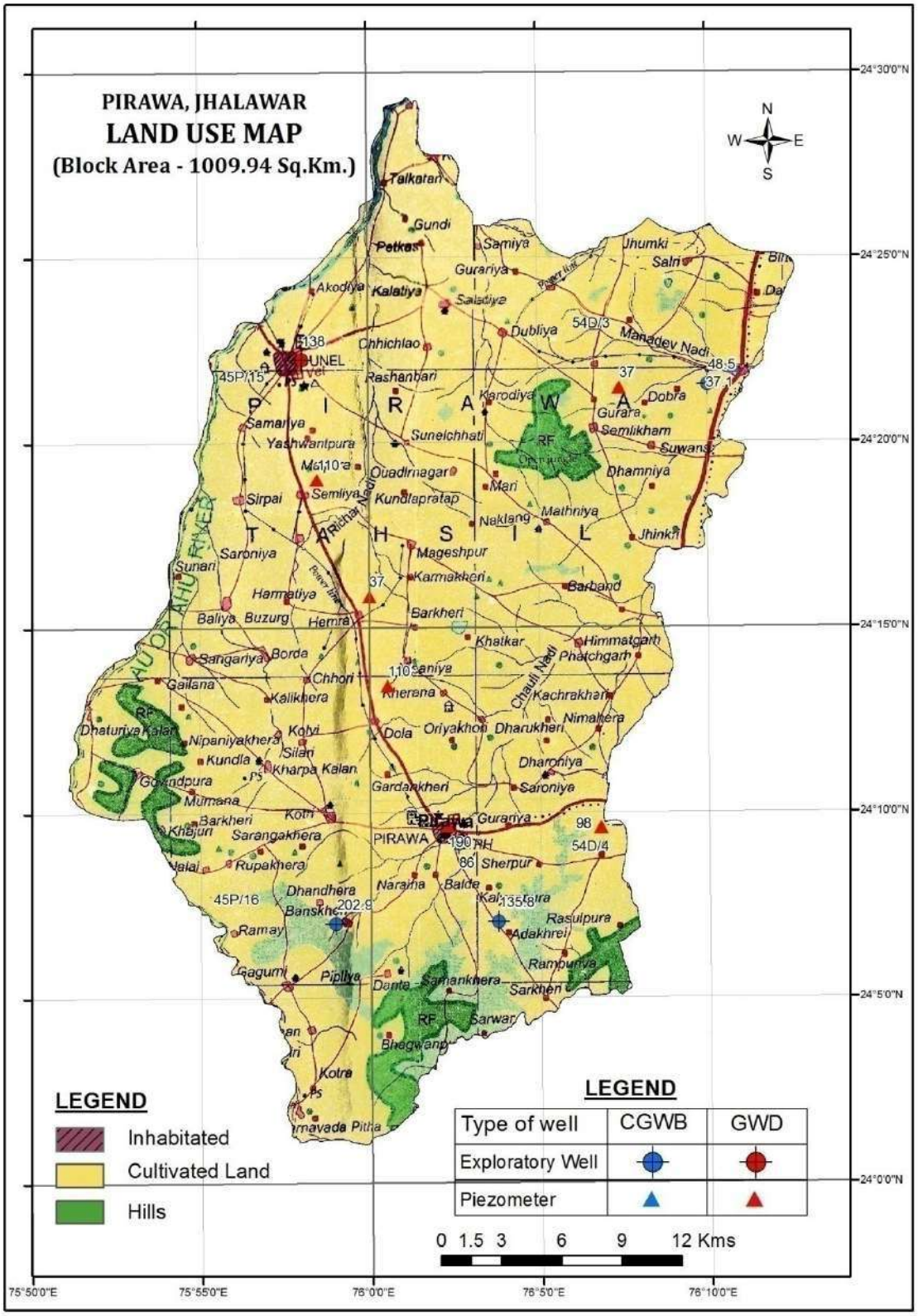


Fig. 80 : Map showing Land Use.

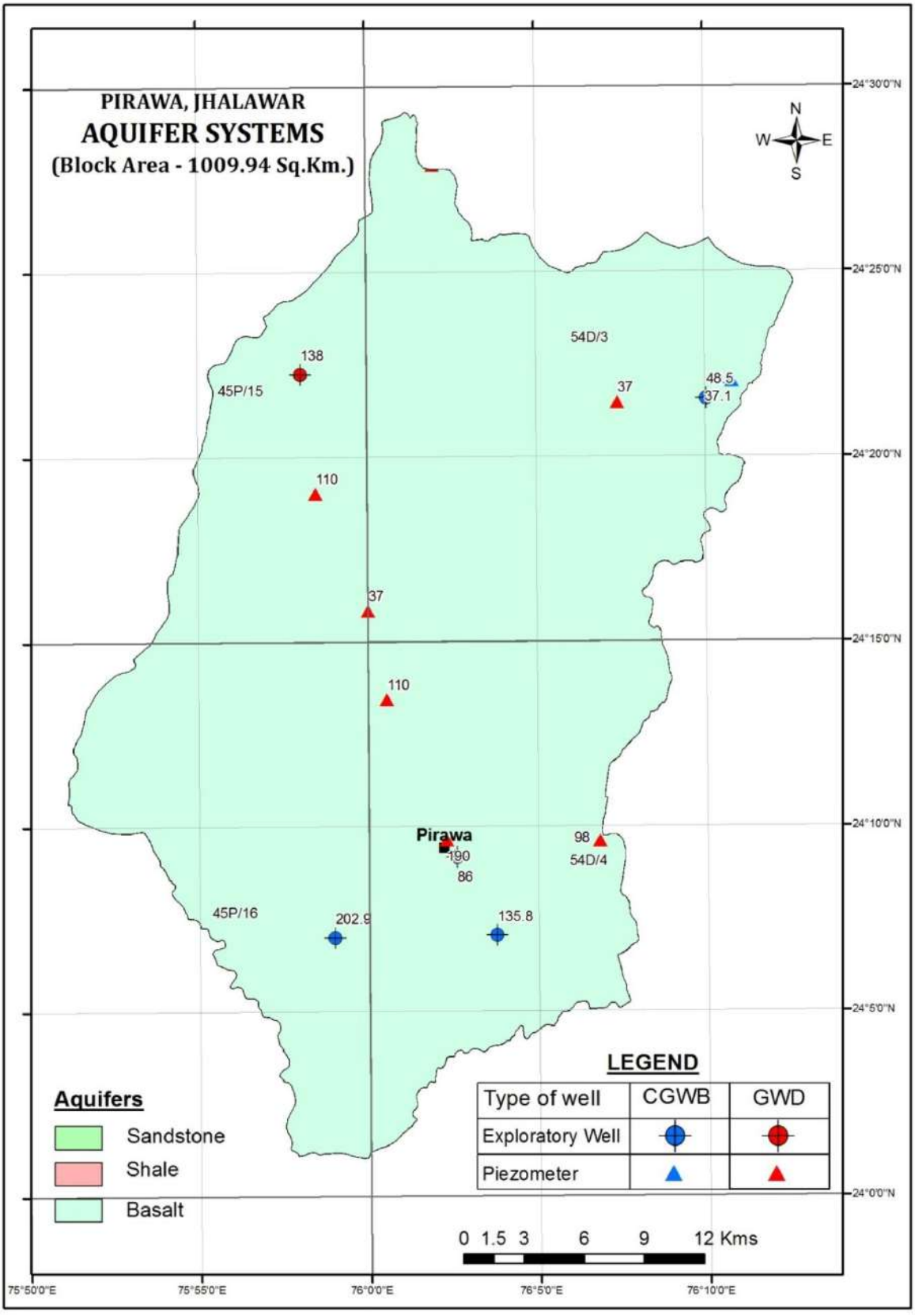
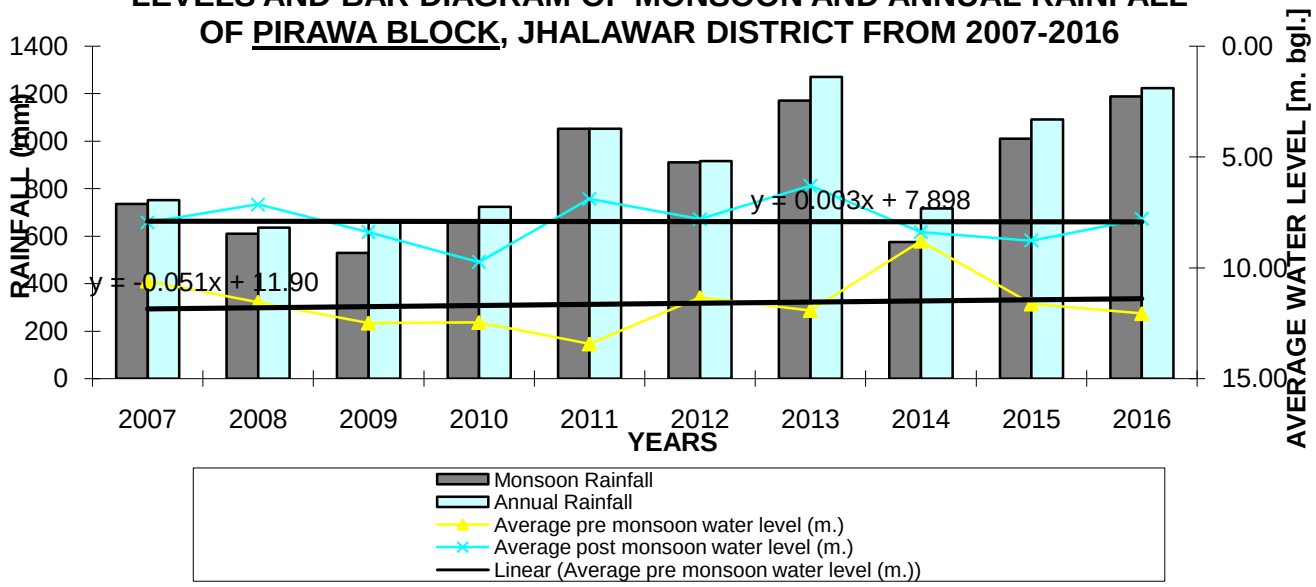
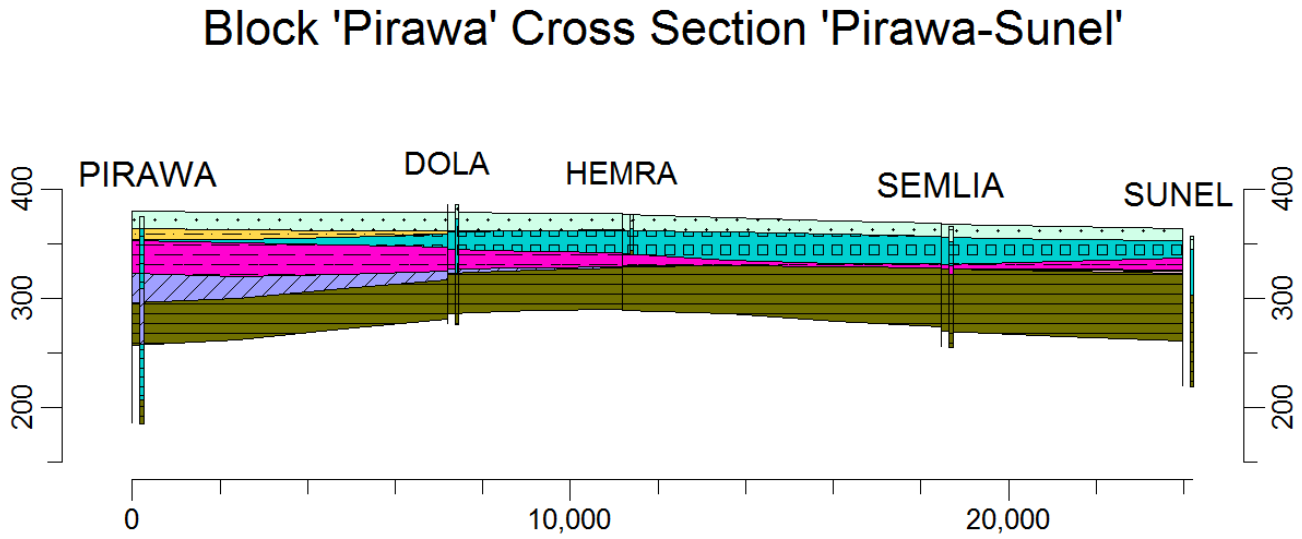


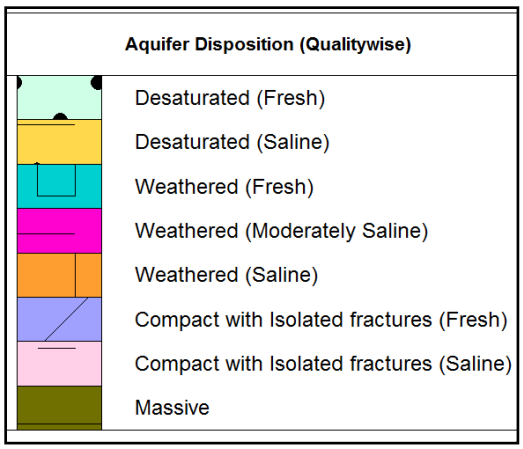
Fig.81 : Map showing Principal Aquifer.

FIG. 82 HYDROGRAPH OF PRE AND POST MONSOON WATER LEVELS AND BAR DIAGRAM OF MONSOON AND ANNUAL RAINFALL OF PIRAWA BLOCK, JHALAWAR DISTRICT FROM 2007-2016



From the selected available data from exploratory wells, various cross sections depicting the aquifer disposition (quality wise) along with aquifer saturation and quality maps using Rockworks software have been prepared which are shown below:





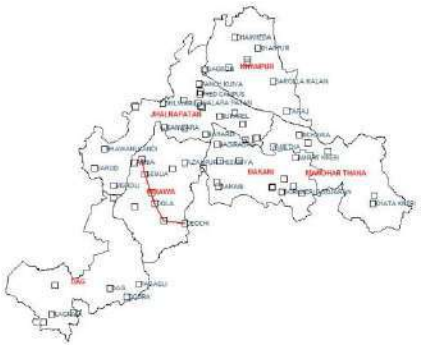


Fig.83 :Map showing aquifer disposition.

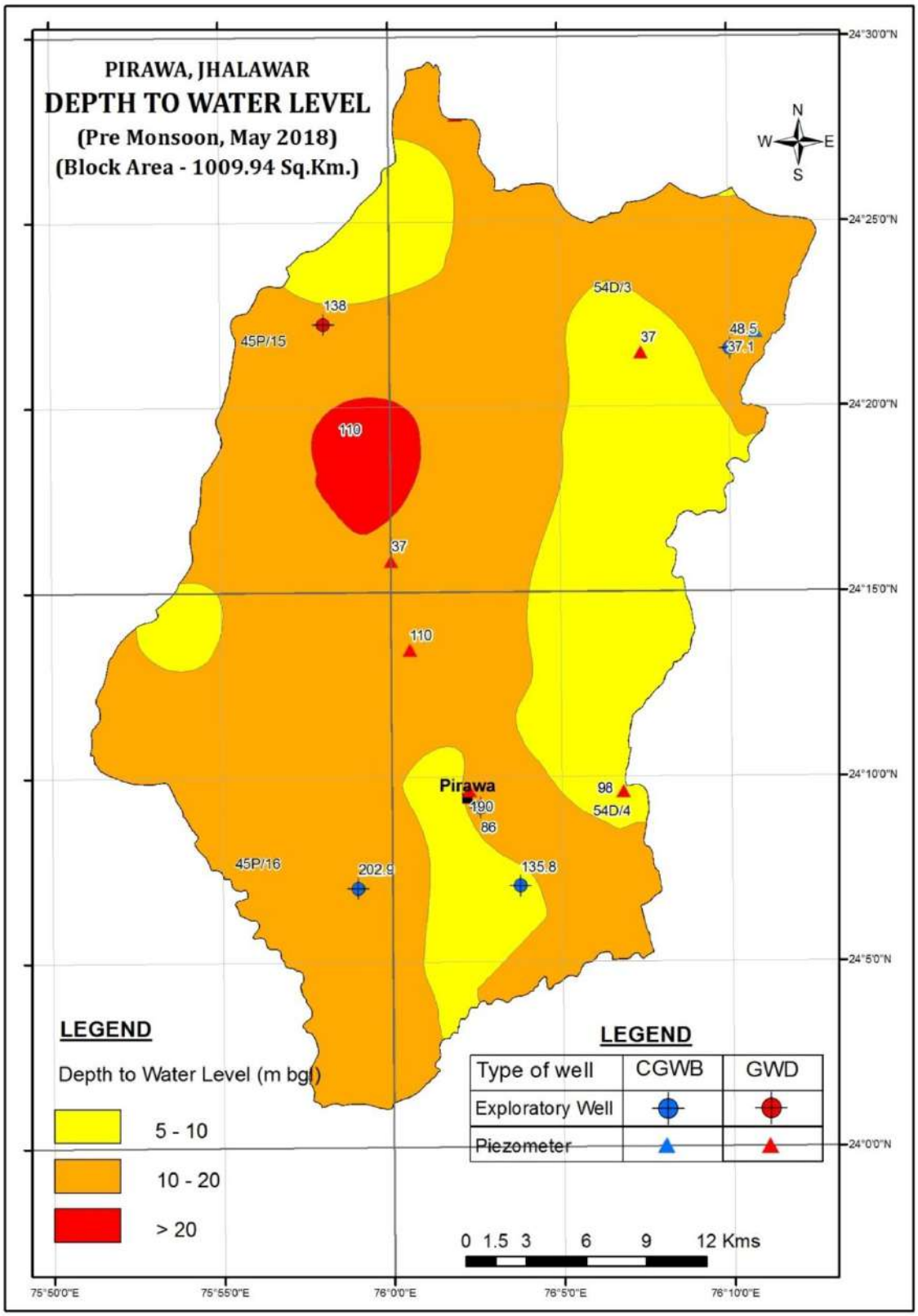


Fig. 84 : Depth to Water Level (Pre Monsoon - May 2018)

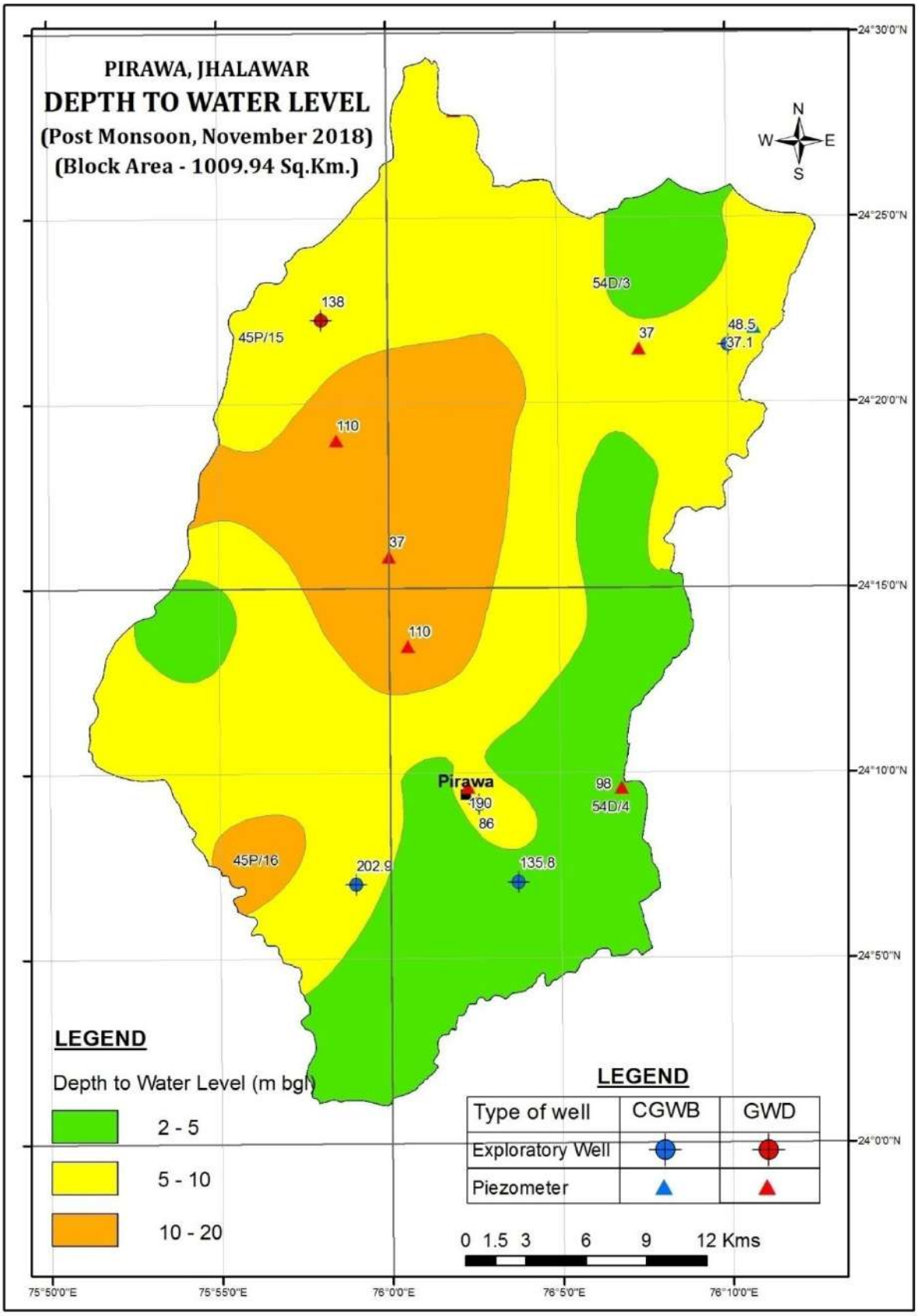


Fig.85 : Depth to Water Level (Post Monsoon - November, 2018)

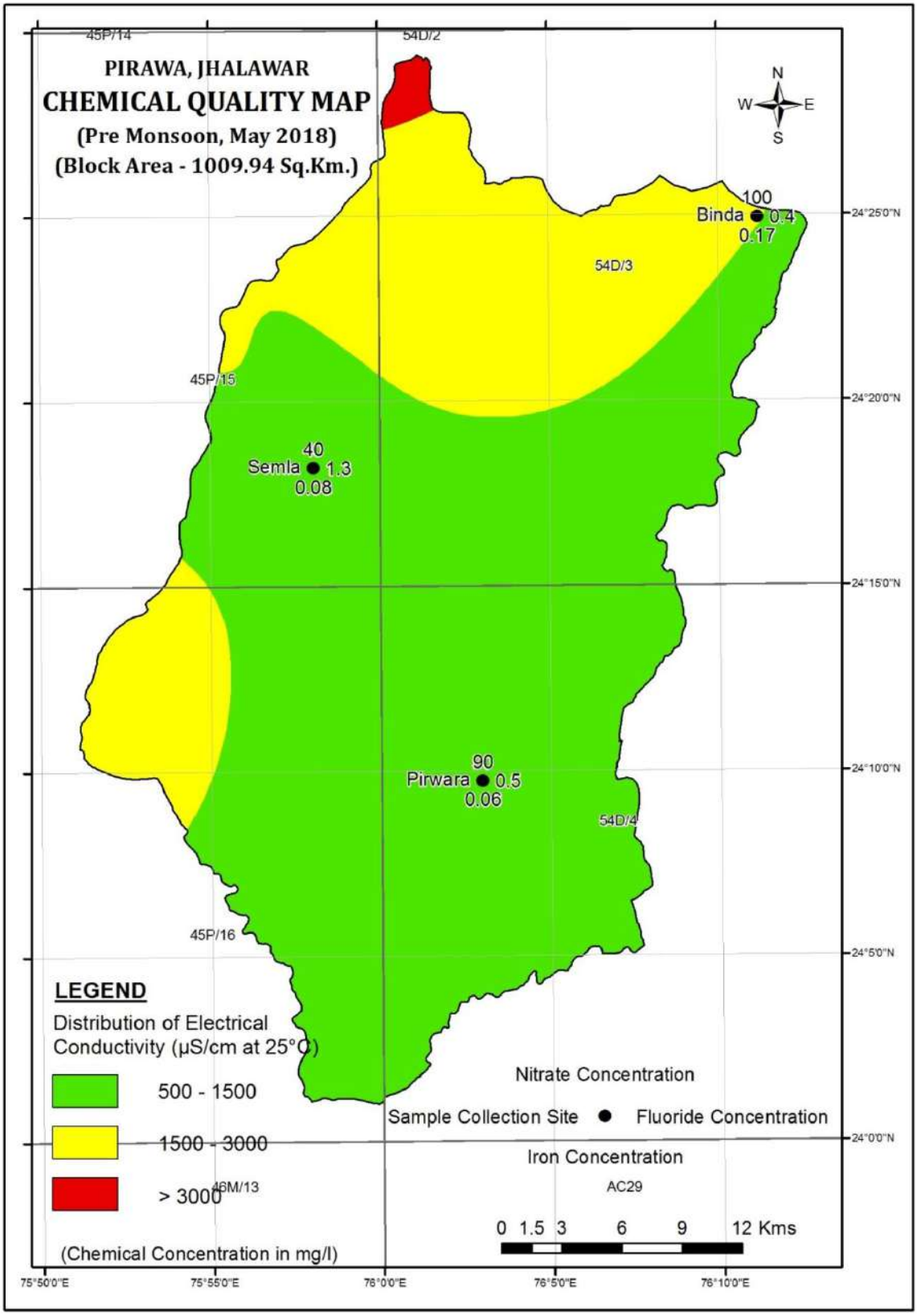


Fig.86: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (May 2018)

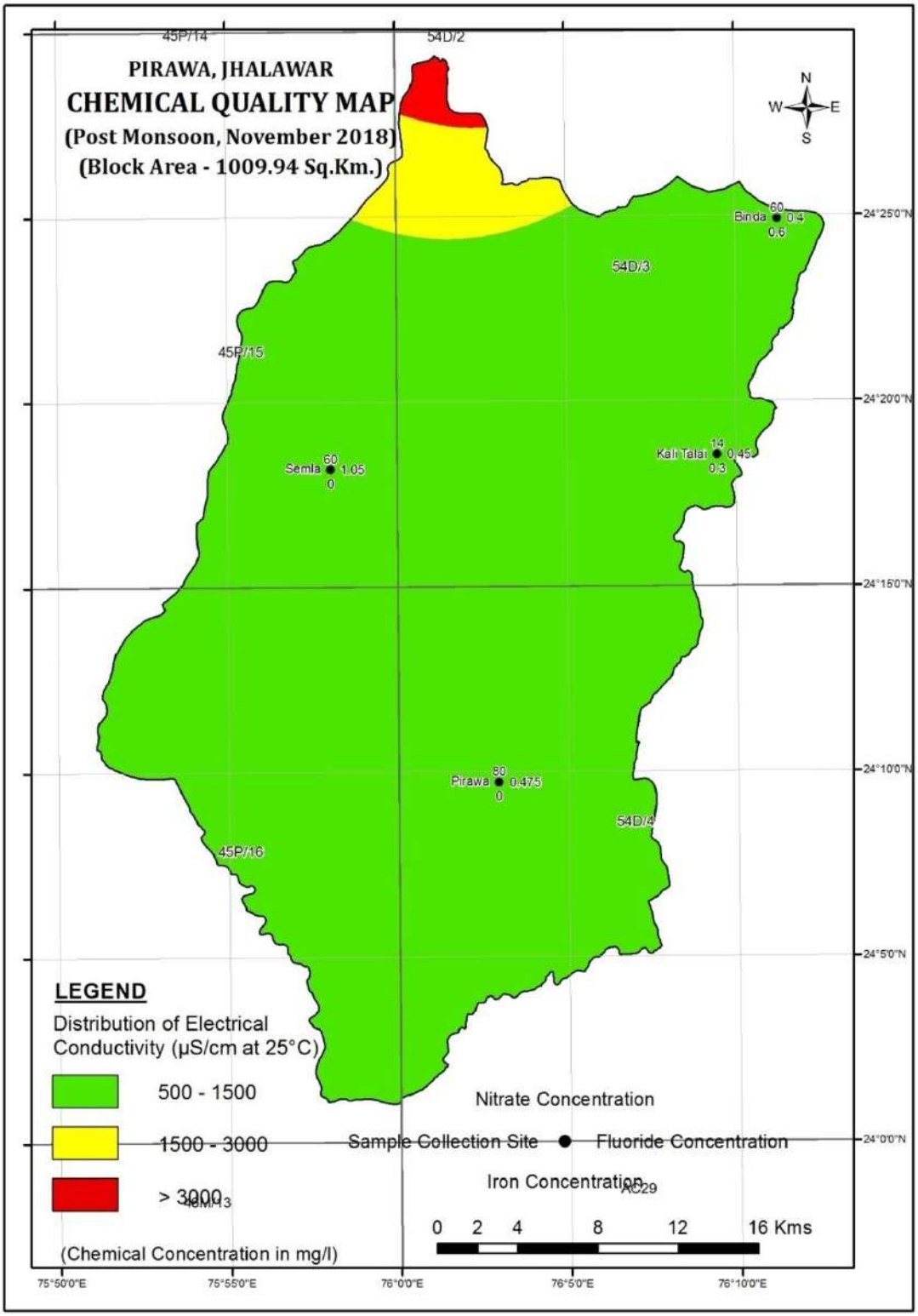


Fig.87: Chemical quality map showing Iso Electrical Conductivity,Iron, Nitrate, & Fluoride distribution (Nov. 2018)

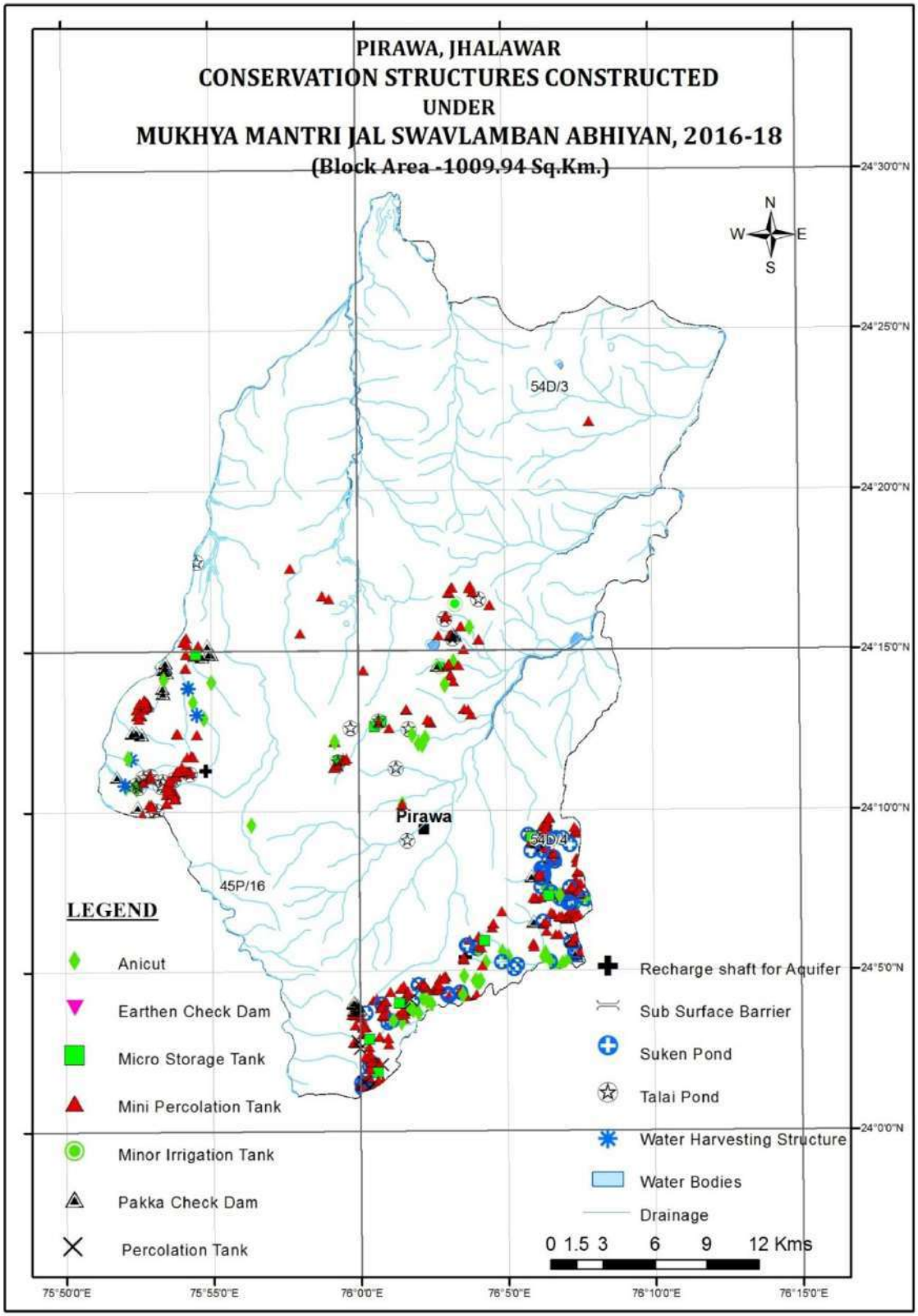


Fig.88 : Map showing locations of different type of recharge structures constructed under MJSA.

Management Plan of Pirawa Block

Salient Information	**Block**	**Pirawa**
	Geographical Area (km2)	1009.94
	Forest Area (Sq.km)	9.34
	Potential Area (Sq.km)	1000.60
Climate & Rainfall	Climate	Hot and Humid
	Average Rainfall (1971-2014)	1032.2
Ground Water Issues	Aquifer Characteristics	Basalt, Unconfined Aquifer
	Main Aquifers in the area	Covered by Hard rocks
Aquifer System	Aquifer Disposition	Weathered alluvium followed by Basalt
	Geology	Basalt
	Maximum Depth of Aquifer in meter	32
	Type of Aquifer	Unconfined Aquifer
	Thickness of Aquifer (Utilisable)	18.5
	Hydraulic Characters (sp.yield%)	0.015
Water Level Behaviour, DTW (m)	Depth to Water Level (m BGL)	12.2
	Trend (m/yr)	0.08
Ground Water Quality	General	
	Electrical Conductivity in microS/cm (Min/Max)	1308.2
	Chloride in mg/ litre (Min/Max)	172.12
	Nitrate in mg/litre (Min/Max)	46
	Fluoride in mg/litre (Min/Max)	0.39
Groundwater Resources	Total annual ground water recharge(mcm)	126.3443
	Natural discharge during non-monsoon season(mcm)	27.8973
	Net ground water availability(mcm)	98.4470
	Existing gross ground water draft for irrigation(mcm)	95.8512
	Existing gross ground water draft for domestic & industrial uses(mcm)	2.4556
	Existing gross ground water draft for all uses(mcm)	98.3068
	Allocation for domestic & industrial requirement(mcm)	7.6836
	Net ground water availability for future irrigation development(mcm)	11.2775
	State of ground water development	99.86
	Category	Critical

Salient Supply Side Management	Block	Pirawa
	Potenital Zone area (sq. km.)	1000.60
	Volume of sub surface storage space available for artificial recharge (mcm)	72.04
	Surplus available as per Tahal Report (in mcm)	167.05
	No. of RS (0.03 MCM/RS)	5568.46
	No of RS possible in block (as per water bodies)	491.00
	25% of Remaining Surplus water for Recharge and Conservation	38.08
	Surplus for Farm pond (0.0027 MCM)	38.08
	No of Farm Pond	14104.05
Expected Benefits	Net G.W. Availability (mcm)	98.45
	Additional Recharge from RWH & conservation (mcm)	33.77
	Total Net G.W. Availability after intervention (mcm)	132.22
	Existing G.W Draft for all purpose (mcm)	98.31
	Net GW draft after interventions (mcm)	98.31
	Present stage of G.W. development (%)	99.86
	Projected stage of G.W. Dev. (in %)	74.35
Other Interventions proposed, if any	Demand side management for sustainable development of ground water resources	Drip, sprinkler & change in cropping pattern.

Part C

Management Plans of Selected villages of Jhalawar District (8 Villages)

1. WATER SECURITY PLAN: Anwalikalan BLOCK : Jhalrapatan DISTRICT : Jhalawar	
Gram/village	Anwalikalan
Introduction	According to Census 2011 information the location code or village code of Anwali Kalan village is 104865. Anwali Kalan village is located in Pachpahar Tehsil of Jhalawar district in Rajasthan, India. It is situated 10km away from sub-district headquarter Pachpahar and 37km away from district headquarter Jhalawar.
long	75.9143
lat	24.4375
Block/Tehsil/Panchayat samiti	Jhalrapatan
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Bhawani Mandi
Nearest Railway Station	Dhuankheri. (6.6 Kmts)
Name of Gram Pradhan / Sarpanch	Anwalikalan/ Sh.Parmanand
Postal Addess of Gram Panchayat with PIN code	Village: Anwalikalan, Post office: Anwalikalan , Tehsil: Jhalrapatan District: Jhalawar (Rajasthan) PIN- 326502
Area(SqKm)	5.97 km^2
Population	Anwali Kalan Village Total population is 1402 and number of houses are 277. Female Population is 49.6%. Village literacy rate is 61.8% and the Female Literacy rate is 22.3%.
Physiographical Description	Mainly Alluvial formation, plain & plateau area, with an elevation range of 361 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Talab and 2 natural drainage from hills.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey, black and brownish
Irrigation Facilities	Ponds, dugwells & borewells 130-150' depth. Total irrigated area in this village is 376.59 hectares from dugwells, Boreholes/ Tube wells.
Floura & Fauna	agriculture crops, orange gardens etc.

Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village.
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish.
Industrialisation	NA
Transport & Communcation	Private & public bus service available in village.
Any other relevant Information	

Census Parameter	Census Data
Total Population	1402
Total No of Houses	277
Female Population %	49.6 % (696)
Total Literacy rate %	61.8 % (867)
Female Literacy rate	22.3 % (312)
Scheduled Tribes Population %	12.5 % (175)
Scheduled Caste Population %	28.7 % (402)
Working Population %	54.1 %
Child(0 -6) Population by 2011	186
Girl Child(0 -6) Population % by 2011	51.1 % (95)

Water Level	13.80 mbgl dt.19.3.2019 of CGWB (EW) constructed.
Sub surface geology	0.0 – 26.00 mbgl: weatherd zone 26.00 –47.30 mbgl: Besalt rock 47.30 –48.30 mbgl: Intertrappeans (greenish clays)
Discharge of Exploratory well	40 lpm
Ground water quality	Good (chemical result awaited) TDS:800

Sources of water (in terms of quantity and quality),irrigation,domestic.,industry	Treated Tap Water Supply all round the year and in summer also available from Pipalaj river dam. dug Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
Demand of water (irrigation sector ,Domestic consumption , Drinking water, animal husbandary ,other consumption)	841.20KLD (Domestic consumption , Drinking water, animal husbandary ,other consumption)
Present status of development (Irrigation sector , Domestic consumption)	Critical
Gap Assessment /Water problem	Nitrate pollution in dugwell (130 mg/l), Un explored area for deeper aquifer, drilling difficulties due to inter-trappean beds of greenish clay balls.
Solutions	Exploration work taken up by the CGWB during current AAP by departmental rig to a depth of 48.30 mbgl and could not penetrate further due to greenish clayey bed(Inter-trappeans) encountered in between basaltic rocks. The quality of water is Nitrate (130mg/l) in dugwell other constituents in safe limits . The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. Presentely the water supply is maintained by the PHED Govt.of Rajasthan from nearby surface dam at Piplaj river.
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

2. WATER SECURITY PLAN: Banskhedi BLOCK : Pirawa DISTRICT : Jhalawar	
Gram/village	Banskhedi
Introduction	Bans Kheri is a small Village/hamlet in Pirawa (sunel) Tehsil in Jhalawar District of Rajasthan State, India. It comes under Bans Kheri Panchayath. It belongs to Kota Division . It is located 66 KM towards South from District head quarters Jhalawar. 17 KM from Pirawa (Sunel). 364 KM from State capital Jaipur
long	76.3131
lat	24.3452
Block/Tehsil/Panchayat samiti	Pirawa
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Pirawa
Nearest Railway Station	There is no railway station near to Bans Kheri in less than 10 km.
Name of Gram Pradhan / Sarpanch	Banskhedi/ Smt.Jas kanwar
Postal Addess of Gram Panchayat with PIN code	Village: Banskhedi, Post office: Pirawai , Tehsil: Jhalrapatan District: Jhalawar (Rajasthan) PIN- 326034
Area(SqKm)	7.68 km^2
Population	Bans Kheri Local Language is Hindi. Bans Kheri Village Total population is 1314 and number of houses are 266. Female Population is 46.8%. Village literacy rate is 40.4% and the Female Literacy rate is 12.3%.
Physiographical Description	Mainly Alluvial formation, plain & plateau area, with an elevation range of 361 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Talab and 2 natural drainage from hills.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey, black and brownish
Irrigation Facilities	Ponds, dugwells & borewells 130-150’ depth. Total irrigated area in this village is 353.04 hectares from dugwells, Boreholes/ Tube wells.
Floura & Fauna	agriculture crops, orange gardens etc.

Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village.
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish.
Industrialisation	NA
Transport & Communcation	Private & public bus service available in village.
Any other relevant Information	

Census Parameter	Census Data
Total Population	1314
Total No of Houses	266
Female Population %	46.8 % (615)
Total Literacy rate %	40.4 % (531)
Female Literacy rate	12.3 % (161)
Scheduled Tribes Population %	0.0 % (0)
Scheduled Caste Population %	19.1 % (251)
Working Population %	57.1 %
Child(0 -6) Population by 2011	199
Girl Child(0 -6) Population % by 2011	43.2 % (86)

Water Level **Sub surface geology** **Discharge of Exploratory well** **Ground water quality**	45.50 mbgl dt.22.12.2019 of CGWB (EW) constructed. 0.0 – 10.70 mbgl: weatherd zone 10.70 –41.20 mbgl: Besalt rock 41.20 –47.30 mbgl: Intertrappeans (greenish clays) 47.30 –154.10 mbgl: Besalt rock 154.10 –160.20 mbgl: Intertrappeans (greenish clays) 160.20 –202.90 mbgl: Vindhyan sandstone 108 lpm Good (chemical result awaited) TDS:1200

Sources of water (in terms of quantity and quality), irrigation,domestic., industry	Treated Tap Water Supply all round the year and in summer also available from surface river dam. dug Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
Demand of water (irrigation sector, Domestic consumption, Drinking water, animal husbandary ,other consumption)	788.40 KLD (Domestic consumption , Drinking water, animal husbandary ,other consumption)
Present status of development (Irrigation sector , Domestic consumption)	Critical
Gap Assessment /Water problem	Un explored area for deeper aquifer, drilling difficulties due to inter-trappean beds of greenish clay balls and poor discharge.
Solutions	Exploration work taken up by the CGWB during current AAP by departmental rig to a depth of 202.90 mbgl and could penetrate further greenish clayey bed(Inter-trappeans) due to mixed in composition encountered in between basaltic rocks and is followed by the vindhyan sandstones. Presently the water supply is maintained by the PHED Govt.of Rajasthan from nearby surface dam /reservoir in adjacent river.
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

3. WATER SECURITY PLAN: Gangdhar BLOCK : Dag DISTRICT : Jhalawar	
Gram/village	**Gangdhar**
Introduction	Gangdhar is a Village in Dag Tehsil in Jhalawar District of Rajasthan State, India. It belongs to Kota Division . It is located 107 KM towards South from District head quarters Jhalawar. 16 KM from Dug. 389 KM from State capital Jaipur.This Place is in the border of the Jhalawar District and Shajapur District. Shajapur District Barod is East towards.It is near to the Madhya Pradesh State Border.
long	75.6215
lat	23.9410
Block/Tehsil/Panchayat samiti	Dag
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Jhalawar
Nearest Railway Station	Chau Mahla (2.2 Kmts)
Name of Gram Pradhan / Sarpanch	Gangdhar/ Sh.Rajesh Neema.
Postal Addess of Gram Panchayat with PIN code	Village: Gangdhar, Post office:Gangdhar, Tehsil: Dag District: Jhalawar (Rajasthan) PIN- 326516
Area(SqKm)	8.14 km^2
Population	Gangdhar Local Language is Hindi. Gangdhar Village Total population is 5506 and number of houses are 1063. Female Population is 48.5%. Village literacy rate is 60.8% and the Female Literacy rate is 23.8%.
Physiographical Description	Mainly Alluvial formation, plain & plateau area, with an elevation range of 426 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Talab and 2 natural drainage from hills.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey, black and brownish
Irrigation Facilities	Ponds, dugwells & shallow borewells 70-80' depth. Total irrigated area in this village is 447.51 hectares from dugwells, Boreholes/ Tube wells.
Floura & Fauna	agriculture crops, orange gardens etc.

Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village.
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish.
Industrialisation	NA
Transport & Communcation	Private & public bus service available in village.
Any other relevant Information	

Census Parameter	**Census Data**
Total Population	5506
Total No of Houses	1063
Female Population %	48.5 % (2668)
Total Literacy rate %	60.8 % (3348)
Female Literacy rate	23.8 % (1309)
Scheduled Tribes Population %	1.5 % (81)
Scheduled Caste Population %	19.1 % (1050)
Working Population %	41.5 %
Child(0 -6) Population by 2011	802
Girl Child(0 -6) Population % by 2011	48.6 % (390)

Water Level	2.72 mbgl dt.26.7.2018 of CGWB (EW) constructed.
Sub surface geology	0.0 – 1.60 mbgl: weatherd zone 1.60 –44.30 mbgl: Besalt rock 44.30 – 53.40 mbgl: Intertrappeans (reddish clays) 53.40 –87.00 mbgl: Besalt rock 87.00 – 90.00 mbgl: Intertrappeans (reddish clays) 90.00 –99.20 mbgl: Besalt rock 99.20 – 105.30 mbgl: Intertrappeans (reddish clays) mixed with gravels.
Discharge of Exploratory well	150 lpm
Ground water quality	Nitrate (80) other constituents in safe limits.

Sources of water (in terms of quantity and quality),irrigation,domestic.,industry	Treated Tap Water Supply all round the year and in summer also available from Choti kalisindh river dam. dug Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
Demand of water (irrigation sector ,Domestic consumption, Drinking water, animal husbandary , other consumption)	3336.00KLD (Domestic consumption , Drinking water, animal husbandary, other consumption)
Present status of development (Irrigation sector , Domestic consumption)	Critical
Gap Assessment /Water problem	Nitrate pollution in dugwell (220 mg/l) and shallow aquifer(80 mg/l), Un explored area for deeper aquifer, drilling difficulties due to inter-trappean beds of greenish clay balls.
Solutions	Exploration work taken up by the CGWB during current AAP by departmental rig to a depth of 105.30 mbgl and could not penetrate further due to reddish clayey bed(Inter-trappeans) encountered in between basaltic rocks. The quality of water is Nitrate (80) other constituents in safe limits and received a discharge well to the tune of 150 lpm . Presentely the water supply is maintained by the PHED Govt.of Rajasthan from nearby surface dam at Choti kalisindh river.
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

4. WATER SECURITY PLAN: Garnavad BLOCK : Jhalrapatan DISTRICT : Jhalawar	
Gram/village	Garnavad
Introduction	Garnawad is a small Village/hamlet in Jhalrapatan Tehsil in Jhalawar District of Rajasthan State, India. It comes under Garnawad Panchayath. It belongs to Kota Division . It is located 27 KM towards west from District head quarters Jhalawar. 22 KM from Jhalrapatan. 318 KM from State capital Jaipur
long	75.97
lat	24.48
Block/Tehsil/Panchayat samiti	Jhalrapatan
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Bhawani Mandi
Nearest Railway Station	Dhuankheri
Name of Gram Pradhan / Sarpanch	Garnawad
Postal Addess of Gram Panchayat with PIN code	Village: Garnawad, Post office: Bhavanimandi , Tehsil: Jhalrapatan District: Jhalawar (Rajasthan) PIN- 326502
Area(SqKm)	1.15 km^2 (1115.84 hectares)
Population	Garnawad Local Language is Hindi. Garnawad Village Total population is 1012 and number of houses are 204. Female Population is 49.2%. Village literacy rate is 60.4% and the Female Literacy rate is 21.4%.
Physiographical Description	Mainly Alluvial formation, plain & plateau area, with an elevation range of 361 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Talab and 2 natural drainage from hills.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey, black and brownish
Irrigation Facilities	Ponds, dugwells & borewells 130-150’ depth. Total irrigated area in this village is 760.26 hectares from dugwells, Boreholes/ Tube wells.
Floura & Fauna	agriculture crops, orange gardens etc.

Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village.
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish and further followed by the vindhyan sandstone & shales.
Industrialisation	NA
Transport & Communcation	Private & public bus service available in village.
Any other relevant Information	

Census Parameter	Census Data
Total Population	1012
Total No of Houses	204
Female Population %	49.2 % (498)
Total Literacy rate %	60.4 % (611)
Female Literacy rate	21.4 % (217)
Scheduled Tribes Population %	1.6 % (16)
Scheduled Caste Population %	37.5 % (379)
Working Population %	50.4 %
Child(0 -6) Population by 2011	120
Girl Child(0 -6) Population % by 2011	50.8 % (61)

Water Level	10.70 mbgl dt.11.6.2018 of dugwell.
Sub surface geology	Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish and further followed by the vindhyan sandstone & shales.
Ground water quality	Poor, saline , Electrical conductivity (5960), Sulphate (930),Nitrate (130) & iron (0.97mg/l) etc.

Sources of water (in terms of quantity and quality), irrigation, domestic., industry	Treated Tap Water Supply all round the year and in summer also available from adjacent river dam/ reservoir. dug Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
Demand of water (irrigation sector, Domestic consumption , Drinking water, animal husbandary , other consumption)	607.20 KLD (Domestic consumption , Drinking water, animal husbandary ,other consumption)
Present status of development (Irrigation sector , Domestic consumption)	Critical
Gap Assessment /Water problem	Salinity, Nitrate pollution in dugwell , Un explored area for deeper aquifers.
Solutions	Exploration work taken may be taken up by the CGWB. The quality of water may be improved by construction of artificial recharge structures, desalinization plants,the drainage may be lined to stopthe waste and fertilisers mixing in ground water flow during rains and after words also.
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). The waste and fertilisers may be the factor for nitrate pollution in ground water so suitable measures are needed. **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • The waste and fertilisers may be stopped to flow & mixing in the ground water by construction of lined drainage to avoid contamination. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

5. Micro-level Aquifer Management Plan : Jolpa BLOCK : Khanpur DISTRICT : Jhalawar	
Gram/village	Jolpa
Introduction	According to Census 2011 information the location code or village code of Jolpa village is 103779. Jolpa village is located in Khanpur Tehsil of Jhalawar district in Rajasthan, India. It is situated 16km away from sub-district headquarter Khanpur and 53km away from district headquarter Jhalawar. As per 2009 stats, Jolpa village is also a gram panchayat. The total geographical area of village is 1549.95 hectares. Jolpa has a total population of 1,843 peoples. There are about 339 houses in Jolpa village. Sangod is nearest town to Jolpa which is approximately 15km away.
longitude	76.1583
lattitude	24.588
Block/Tehsil/Panchayat samiti	Khanpur
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Sangod
Nearest Railway Station	No railway station available within 10 kms. Chajawa is nearby railway station (29.5 Kilometres)
Name of Gram Pradhan / Sarpanch	Jolpa/
Postal Addess of Gram Panchayat with PIN code	Village: Jolpa, Post office: Khanpur, Tehsil: Khanpur District: Jhalawar (Rajasthan) PIN- 326038
Area(SqKm)	1549.95 hectares
Population	1843 (census2011)
Physiographical Description	Mainly alluvial formation, plain area, with an elevation range of 250.0 metres amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Ponds, 2 localized river/drainage flows in rainy season is available.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall (mm)	The monsoon season spread over months of July to September, Annual average of 781.2 mm of rainfall.
Soil	Grey and brownish clayey soil
Irrigation Facilities	Ponds, dugwells & shallow borewells are used for irrigation.
Floura & Fauna	NA
Agriculture	Mainly Wheat, soyabean,Onion, garlic & coriander etc. crops are shown.
Animal Husbandary	NA

<table>
<tr><td>Mines & Minerals</td><td>NA, Alluvial area underlain by vindhyan supergroup rocks.</td></tr>
<tr><td>Industrialisation</td><td>NA</td></tr>
<tr><td>Transport & Communcation</td><td>Private bus available in village & public bus service available within 5-10 kms distance.</td></tr>
<tr><td>Any other relevant Information</td><td>
<table>
<tr><th>Census Parameter</th><th>Census Data</th></tr>
<tr><td>Total Population</td><td>1843</td></tr>
<tr><td>Total No of Houses</td><td>339</td></tr>
<tr><td>Female Population %</td><td>48.5 % (894)</td></tr>
<tr><td>Total Literacy rate %</td><td>68.9 % (1270)</td></tr>
<tr><td>Female Literacy rate</td><td>27.9 % (514)</td></tr>
<tr><td>Scheduled Tribes Population %</td><td>1.6 % (30)</td></tr>
<tr><td>Scheduled Caste Population %</td><td>28.2 % (520)</td></tr>
<tr><td>Working Population %</td><td>53.9 %</td></tr>
<tr><td>Child(0 -6) Population by 2011</td><td>242</td></tr>
<tr><td>Girl Child(0 -6) Population % by 2011</td><td>48.8 % (118)</td></tr>
</table>
</td></tr>
<tr><td>Sources of water (in terms of quantity and quality),irrigation,domestic.,industry</td><td>Ponds, dugwells, handpumps & shallow borewells.</td></tr>
<tr><td>Demand of water (irrigation sector ,Domestic consumption , Drinking water, animal husbandary ,other consumption)</td><td>110.580 KLD (Domestic consumption , Drinking water, animal husbandary ,other consumption)</td></tr>
<tr><td>Present status of development (Irrigation sector , Domestic consumption)</td><td>Village falls under Over exploited block Khanpur (Stage of ground water development (109.6%)).</td></tr>
<tr><td>Gap Assessment /Water problem</td><td>Dugwell zone dried up, shallow borewells with poor to moderate discharge, quality issues etc.
The problem of water scarcity during the cultivation of Rabi crops</td></tr>
<tr><td>Ground water quality</td><td>The all chemical constituents found within safe limits and the water is potable..</td></tr>
<tr><td>Solutions</td><td>Management Plan: In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management.
Supply Side Management: The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge.
Demand Side Management: By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea).
Exploration of deep aquifer, awareness among stakeholders & their participation.</td></tr>
</table>

	Techniques applied by villagers to meetout deeper water level in nearby village Moikhurd, village community is maintaining supply from unused Handpumps (Pic attached) 
Works to be taken	One site finalised for exploration by departmental DTH Rig of deep aquifer in govt.school ground near Kisan seva kendra. Ground water recharge structures construction & maintenance.
Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB. Tthe work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Jolpa, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

6. WATER SECURITY PLAN: Kyasara BLOCK : Dag DISTRICT : Jhalawar	
Gram/village	**Kyasara**
Introduction	Kyasara Village, with population of 1268 is Gangdhar sub district's the 31st most populous village, located in Gangdharsub district of Jhalawar district in the state Rajasthan in India. Total geographical area of Kyasara village is 7 km^2 and it is the 38th biggest village by area in the sub district. Population density of the village is 186 persons
long	75.8447
lat	23.9773
Block/Tehsil/Panchayat samiti	Dag
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Jhalawar (98 km)
Nearest Railway Station	No railway station available within 10 kms.
Name of Gram Pradhan / Sarpanch	Kyasara/ Smt. Urmila devi.
Postal Addess of Gram Panchayat with PIN code	Village: Kyasara, Post office:Kyasara, Tehsil: Dag District: Jhalawar (Rajasthan) PIN- 326514
Area(SqKm)	7 km^2
Population	1268 (census2011), Kayasara Local Language is Hindi. The village is home to 1268 people, among them 639 (50%) are male and 629 (50%) are female. 84% of the whole population are from general caste, 16% are from schedule caste. Child (aged under 6 years) population of Kyasara village is 16%, among them 58% are boys and 43% are girls. There are 236 households in the village and an average 5 persons live in every family.
Physiographical Description	Mainly Alluvial formation, plain & hilly area, with an elevation range of 426 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Talab and 2 natural drainage from hills.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey and brownish
Irrigation Facilities	Ponds, dugwells & shallow borewells 70-80' depth. Total irrigated area in this village is 349 hectares from dugwells, Boreholes/ Tube wells.
Floura & Fauna	agriculture crops, orange gardens etc.

Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village.
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish.
Industrialisation	NA
Transport & Communcation	Private & public bus service available in village.
Any other relevant Information	

Census Parameter	Census Data
Total Population	1268
Total No of Houses	236
Female Population %	49.6 % (629)
Total Literacy rate %	47.3 % (600)
Female Literacy rate	17.4 % (221)
Scheduled Tribes Population %	0.0 % (0)
Scheduled Caste Population %	16.4 % (208)
Working Population %	40.1 %
Child(0 -6) Population by 2011	200
Girl Child(0 -6) Population % by 2011	42.5 % (85)

Water Level	12.75 mbgl dt.5.11.2018 of CGWB (EW) constructed.
Sub surface geology	0.0 – 4.60 mbgl: weatherd zone 4.60 –77.50 mbgl: Besalt rock 77.50 – 77.80 mbgl: Intertrappeans (greenish clays)
Discharge of Exploratory well	751 lpm
Ground water quality	Good.
Sources of water (in terms of quantity and quality), irrigation, domestic, industry	Treated Tap Water Supply all round the year and in summer also available from bhaminy dam. dug Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.
Demand of water (irrigation sector, Domestic consumption, Drinking water, animal husbandary ,other consumption)	760.89 KLD (Domestic consumption , Drinking water, animal husbandary, other consumption)

Present status of development (Irrigation sector , Domestic consumption)	Critical
Gap Assessment /Water problem	Un explored area for deeper aquifer, drilling difficulties due to inter-trappean beds of greenish clay balls.
Solutions	Exploration work taken up by the CGWB during current AAP by departmental rig to a depth of 77.80 mbgl and could not penetrate further due to greenish clayey bed(Inter-trappeans) encountered in between basaltic rocks. The quality of water is good and received a high discharge well to the tune of 751 lpm (Pic attached) .  Presently the water supply is maintained by the PHED Govt.of Rajasthan from nearby surface dam at village Bhaminy.
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

7. WATER SECURITY PLAN: Pagariya BLOCK : Dag DISTRICT : Jhalawar	
Gram/village	**Pagariya**
Introduction	Pagariya is a village positioned in Dag Block, Dag Tehsil of Jhalawar district in Rajasthan. Placed in rural part of Jhalawar district of Rajasthan, it is one among the 231 villages of Dag Block of Jhalawar district. According to the government records, the village number of Pagariya is 104965. It belongs to Kota Division. It is located 71 KM towards South from District head quarters Jhalawar. 24 KM from Dug. Total geographical area of Pagariya village is 10 km^2 and it is the 11th biggest village by area in the sub district. Population density of the village is 364 persons per km^2.
long	75.8606
lat	24.1286
Block/Tehsil/Panchayat samiti	Dag
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Bhawani Mandi (38 km)
Nearest Railway Station	No railway station available within 10 kms. The nearest railway station to Pagariya is Suwasra which is located in and around 22.5 kilometer distance.
Name of Gram Pradhan / Sarpanch	Pagariya/ sh.dhirap singh s/o Sh. Rod singh
Postal Addess of Gram Panchayat with PIN code	Village: Pagariya, Post officePachpahar, Tehsil: Dag District: Jhalawar (Rajasthan) PIN- 326512
Area(SqKm)	10 km^2
Population	3800 (census2011), Pagariya Local Language is Hindi. Pagariya Village Total population is 3800 and number of houses are 775. Female Population is 48.1%. Village literacy rate is 43.3% and the Female Literacy rate is 14.0%.
Physiographical Description	Mainly Alluvial formation, plain & hilly area, with an elevation range of 426 meters amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	3 Anicuts,1 pakka check dam natural drainage (kyasara drain)
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, An average of 781.2 mm of rainfall.
Soil	Grey and brownish
Irrigation Facilities	Ponds, dugwells & shallow borewells 70-80' depth. Total irrigated area in this village is 789 hectares from dugwells, Boreholes/ Tube wells construction of canal from bhaminy dam for irrigation is underway.
Floura & Fauna	agriculture crops , orange garden.

	
Agriculture	Soybean, Makki coriander,cereals and Wheat are agriculture commodities grow in this village. 
Animal Husbandary	
Mines & Minerals	NA, Alluvial area underlain by deccan traps (Besalt) and intertrappeans beds of clays red & greenish.
Industrialisation	NA
Transport & Communication	Private & public bus service available in village.

<table>
<tr><td>Any other relevant Information</td><td>
<table>
<tr><th>Census Parameter</th><th>Census Data</th></tr>
<tr><td>Total Population</td><td>3800</td></tr>
<tr><td>Total No of Houses</td><td>775</td></tr>
<tr><td>Female Population %</td><td>48.1 % (1828)</td></tr>
<tr><td>Total Literacy rate %</td><td>43.3 % (1647)</td></tr>
<tr><td>Female Literacy rate</td><td>14.0 % (532)</td></tr>
<tr><td>Scheduled Tribes Population %</td><td>0.1 % (2)</td></tr>
<tr><td>Scheduled Caste Population %</td><td>24.0 % (912)</td></tr>
<tr><td>Working Population %</td><td>35.8 %</td></tr>
<tr><td>Child(0 -6) Population by 2011</td><td>561</td></tr>
<tr><td>Girl Child(0 -6) Population % by 2011</td><td>48.8 % (274)</td></tr>
</table>
</td></tr>
<tr><td>Water Level</td><td>5.67 mbgl dt.16.10.2018 of CGWB (EW) constructed.</td></tr>
<tr><td>Sub surface geology</td><td>0.0 – 13.80 mbgl: weatherd zone
13.80 – 68.70 mbgl: Besalt rock
68.70 – 74.80 mbgl: Intertrappeans (Red clays)
74.80 – 105.30 mbgl: Besalt rock
105.30 – 108.30 mbgl: Intertrappeans (Red clays)
108.30 -117.50 mbgl: Besalt rock.</td></tr>
<tr><td>Discharge of Exploratory well</td><td>1000 lpm</td></tr>
<tr><td>Ground water quality</td><td>Good.</td></tr>
<tr><td>Sources of water (in terms of quantity and quality), irrigation,domestic, industry</td><td>Treated Tap Water Supply all round the year and in summer also available from bhaminy dam. Covered Well, UnCovered Well, Hand Pump and Tube Wells/Boreholes are other Drinking Water sources.</td></tr>
<tr><td>Demand of water (irrigation sector, Domestic consumption, Drinking water, animal husbandary, other consumption)</td><td>228.0 KLD (Domestic consumption , Drinking water, animal husbandary, other consumption)</td></tr>
<tr><td>Present status of development (Irrigation sector, Domestic consumption)</td><td>Critical</td></tr>
<tr><td>Gap Assessment /Water problem</td><td>Un explored area for deeper aquifer, drilling difficulties due to inter-trappean beds of lateritic clay balls.</td></tr>
<tr><td>Solutions</td><td>Exploration work taken up by the CGWB during current AAP by departmental rig to a depth of 117.30 mbgl and could not penetrate further due to redballs encountered in between basaltic rocks.
The quality of water is good and received a high discharge well to the tune of 1000 lpm (Pic attached) .
Presentely the water supply is maintained by the PHED Govt.of Rajasthan from nearby surface dam at village Bhaminy.</td></tr>
</table>

	
Works to be taken	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea). **Exploration of deep aquifer:** Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.

Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB & the work of artificial recharge structures is to be implemented by the Gram Panchayat Jolpa, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The Panchayat will submit a monthly report of physical an d financial achievement to the block level committee , which is responsible for monitoring of the implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Pagariya, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

8. Micro-level Aquifer Management Plan : Ratlai B LOCK : Bakani DISTRICT : Jhalawar	
Gram/village	Ratlai
Introduction	Ratlai is a Village in Bakani Tehsil in Jhalawar District of Rajasthan State, India. It belongs to Kota Division . It is located 34 KM towards South from District head quarters Jhalawar. 6 KM from Bakani. 336 KM from State capital Jaipur
long	76.3126
lat	24.3741
Block/Tehsil/Panchayat samiti	Bakani
DISTRICT	Jhalawar
State	Rajasthan
Nearest Town (with distance)	Bakani
Nearest Railway Station	No railway station available within 10 kms. Jhalrapatan is nearby railway station (28.0 Kilometres)
Name of Gram Pradhan / Sarpanch	Ratlai/
Postal Addess of Gram Panchayat with PIN code	Village: Ratlai, Post office: Jhalra patan, Tehsil:Bakani District: Jhalawar (Rajasthan) PIN- 326023
Area(SqKm)	909.39 hectares
Population	7743 (census2011)
Physiographical Description	Mainly Alluvial/besaltic formation, plateau area, with an elevation range of 250.0 metres amsl.
River & Drainage System No. of ponds/Anicuts/Bandha	2 Ponds, 1 localized river/drainage flows in rainy season is available.
Climate	The climate of the area is with hot summer and delightfully cold winters than to the typical arid parts of Rajasthan.
Temperature	In summer maximum temperature is 47 °C and in winter minimum temperature is 9.5 °C
Rainfall(mm)	The monsoon season spread over months of July to September, Annual average of 781.2 mm of rainfall.
Soil	Grey and blackish clayey (Weathered top soil)
Irrigation Facilities	Ponds, large dia. dugwells & shallow borewells are used for irrigation.
Floura & Fauna	
Agriculture	Mainly Wheat, soyabean,Onion, garlic & coriander etc. crops are shown.
Animal Husbandary	NA
Mines & Minerals	NA, Alluvial area underlain by Beasaltic rock (alternate bands of volcanic flows & intertrappeans) followed by Vindhyans (Sandstone & shales)
Industrialisation	NA
Transport & Communcation	Private bus available in village & public bus service available within 5-10 kms distance.

Any other relevant Information

Census Parameter	Census Data
Total Population	7743
Total No of Houses	1537
Female Population %	48.9 % (3789)
Total Literacy rate %	59.0 % (4570)
Female Literacy rate	23.5 % (1821)
Scheduled Tribes Population %	5.0 % (386)
Scheduled Caste Population %	17.0 % (1320)
Working Population %	36.9 %
Child(0 -6) Population by 2011	1103
Girl Child(0 -6) Population % by 2011	45.3 % (500)

Sources of water (in terms of quantity and quality), irrigation, domestic, industry

PHED supply from Chapi dam (300KLD) & deep Tubewells (200KLD) Ponds, dugwells, of large square shaped Bavadi handpumps etc.

A view of large dia dugwell (26.5 mtrs.) being used for water supply in the village.

A view of borewell/ tubewell being used for water supply of the village

Demand of water (irrigation sector ,Domestic consumption , Drinking water, animal husbandary ,other consumption)	104.58 KLD (based on census2011) and 550.0 KLD reported by the Gram panchayat (Domestic consumption , Drinking water, animal husbandary, other consumption). 
Present status of development (Irrigation sector , Domestic consumption)	Village falls under Critical block Bakani (Stage of ground water development (98.2%)).
Ground water quality	Nitrate pollution (100mg/l) observed from the sample of large square shaped Bavadi used for village supply. The other chemical constituents found within safe limits.
Gap Assessment /Water problem	Mainly dependency on surface water and deep tubewells. Difficult condition of subsurface formation for drilling (Inter-trappean rocks in the form of Red & grey balls of clay & boulders). The problem of water scarcity during the cultivation of Rabi crops.
Solutions	**Management Plan:** In order to manage the ground water resources and to control further decline in water levels, a management plan has been proposed. The management plan comprises two components- supply side management and demand side management. **Supply Side Management:** The supply side management of ground water resources can be done through the artificial recharge of surplus runoff available within river sub basins and micro watersheds. Also it is necessary to understand the de-saturated aquifer volume available for recharge. **Demand Side Management:** By applying the techniques of demand side management can save large amount of water. Demand side management has been proposed through three interventions – use of sprinkler irrigation in the areas where rabi crop is being irrigated through ground water, use of drip irrigation in areas cultivated under oranges and changing the more water intensive wheat crop to gram (chick pea).

	Exploration of deep aquifer: Deep drilling for successful borewells can be achieved by use of high capacity compressors and telescopic drilling and use of perforated pipes in inter-trappean beds for getting good discharge. Construction of artificial recharge structures, awareness among stakeholders & their participation.
Works to be taken	• To take up the deep drilling exploration with suitable DTH rig with telescopic drilling and use of perforated pipes in inter trappean beds for getting good discharge. • Construction of artificial recharge structures, awareness among stakeholders & their participation.
Implementation mechanism	The work of Ground water exploration is to be taken up by the CGWB. The work of artificial recharge structures is to be implemented by the Gram Panchayat Ratlai, Department of Panchayati Raj , Government of Rajasthan. The panchayat will prepare the scheme in consultation with the village / block level committee. The schemes will be submitted to the District Level Committee for its appraisal in order to ensure that the same is in conformity with the water security plan . Subsequently , the Gram Panchayat will obtain necessary approvals and finalise the funding arrangement . An action plan will be prepared for implementation of the scheme . The panchayat will also prepare a completion report after execution of the work is over so that process for transfer of responsibilty for O & M could be initiated.
operation and maintenance	Gram Panchayat Ratlai, Department of Panchayati Raj or PHED department, Government of Rajasthan
Conclusions & Recommendations	• Solutions provided in Management plan including supply side management and demand side management. • Construction of artificial recharge structures like percolation tanks, deepening of ponds, anicuts etc. • Exploration of deep aquifer,in respect of quantity and quality for future use. • Cultivation of low water requirement crops. • Awareness among stakeholders & their participation for ground water recharge and judicious use of available resource.

Conclusions :

After implementing proposed projects the projected stage of groundwater development is calculated as 70.79% which means apart from current available ground water i.e. 547.0 mcm there can be additional groundwater available in the district i.e. 215.16 mcm. This additional water can be used for irrigation in wastelands of around 1048.22 sq km. As the total wasteland present in the district is 2567.42 sq km where 1057.98 sq km is the land affected by salinity/alkalinity which can be restored and irrigated. Rest of the wasteland comprises deep/shallow ravine land can also be restored and irrigated after land levelling which will reduce the water usage. The increase in irrigated area will help in the socio-economic development of the district.

The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. During Pre-monsoon (May, 2018), depth to water level was found to vary from 2 to more than 20m bgl. Water level is shallower in Eastern & southern part of the district. In general, the depth of water level increases from south to north. Water level in the range of 5 to 10 m bgl was observed in major part of Jhalrapatan and small areas in Dag, Pirawa and ManoharThana blocks. The deeper water level in the range of more than 20 m bgl was observed in isolated pocket in Pirawa, Khanpur & J.Patan blocks.

During Post-monsoon (November, 2018), depth to water level in major part of the district was observed to be between 2 and 10 m bgl. The deeper water level in the range of 10 to 20 m bgl was observed in isolated pocket in Pirawa, Khanpur & J.Patan blocks.

The difficulties observed in drilling and construction of borewells in deccan traps specially penetrating different flows and intertrappeans (Red & Green balls formation) can be solved by use of higher psi compressor in DTH Rigs and use of part assembly pipes (Blank/ slotted) in inter-trappeans bed of sticky clayey nature.It is recommended to explore the deeper aquifer by use of suitable drilling techniques to penetrate the inter-trappeans & different flows.

In general, a slight improvement in water quality post monsoon is observed as concentration of almost all parameters decreasing with exception of nitrate, fluoride, sodium and potassium at isolated locations.

The groundwater samples having high nitrate concentration need remedial measures before potable uses.Bioremediation, physical adsorption, reverse osmosis,and solar distillation are some of the helpful techniques for nitrate elimination for safe drinking water.

The Impact study is to be conducted about the change in the Ground water scenario after construction of recharge structure under MJSA (Mukhyamantri Jal Swavlamban

abhiyan) during different phases and Jal shakti abhiyan by the rajasthan state government & Government of India.

The stage of development can be brought down to a level 70.79% (safe category) level by implementing supply side management, However demand side management can be used for future ground water sustainability.

The management plan will be reviewed after assessment of impact study after construction of Recharge structures under above two schemes.

Recommendations:

- ✓ Ground water draft is high in the blocks. Stage of ground water development in the district has reached 98.64% due to indiscriminate use. It has to be controlled by preventing further development.
- ✓ Revival of traditional rainwater storage system i.e. Baori, open wells, tanka etc. for rainwater conservation for use in day to day life will reduce ground water draft.
- ✓ The stage of development can be brought down to a level 70.79% (safe category) level by implementing supply side management, However demand side management can be used for future ground water sustainability.
- ✓ Awareness programme on rainwater harvesting will be beneficial to check decline in water level and justified use.
- ✓ Taking advantage of uneven topography of the hard rock area small water harvesting system or earthen dams, up streams of irrigation commands at suitable sites may be constructed to store rainwater. This will increase recharge of ground water which ultimately results in increase yield of wells.
- ✓ Modern agriculture management techniques have to be adopted and optimum utilization of the water resource
- ✓ High water requirement crops should be discouraged. Proper agricultural extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops.
- ✓ Pricing of ground water for irrigation use may also be considered to reduce the stress on ground water.
- ✓ Reuse of domestic wastewater for gardening, recharge etc.
- ✓ Promoting economic use of water in bathing, cleaning, cooking etc.
- ✓ Leakage from domestic taps, pipelines for water supply to urban/ rural areas be checked effectively.

- ✓ Treatment of industrial effluents so as to check pollution of fresh groundwater resources
- ✓ Use of treated industrial wastewater for irrigation, horticulture.

Acknowledgement:

The author is grateful to Dr. S.K. Jain, Regional Director, Central Ground Water Board, WR, Jaipur for assigning the report and providing necessary guidance. The author expresses thanks to the officers of Regional office data centre, Dr. Balwinder Kaur Scientist-D & other chemists of chemical laboratory, Drawing section, Technical cell, Resource estimation cell, Geophysical section etc. of Jaipur Regional office and the Rajasthan state government agencies for making available the related data. The author expresses thanks to Sh. M.K.Sharma, Scientist-D, Sh. S.K.Pareek, Scientist 'D' & Sh. J.K.Tandon, Draftsman for valuable support in completion of this report.

Annexure-I

List of wells considered for Pre & post-monsoon period water levels year 2018

S.No.	Village		Block	District	Well Type	Latitude	Longitude	RL (m)	Hyd_Formation	Zone	Total_Depth_bgl	WL_pre_18	WL_Post_18
1	Amratkheri	GWD	Aklera	Jhalawar	Dug Well	24.3639	76.5167	331.04	Basalt	B (NC)	10.1	7	3.7
2	Asalpur	GWD	Aklera	Jhalawar	Dug Well	24.2708	76.5042	329.12	Basalt	B (NC)	11.7	9.1	7.35
3	Bairagarh	GWD	Aklera	Jhalawar	Dug Well	24.3458	76.4292	365.62	Basalt	B (NC)	15.95	12.45	7.17
4	Banskheri Lodhan	GWD	Aklera	Jhalawar	Dug Well	24.2444	76.5272	366.92	Basalt	B (NC)	9.2	7.7	3.59
5	Barkhera Khurd	GWD	Aklera	Jhalawar	Dug Well	24.2292	76.2542	374.82	Basalt	B (NC)	12.8	7.9	2.19
6	Bhalta	GWD	Aklera	Jhalawar	Dug Well	24.2708	76.4361	351.39	Basalt	B (NC)	8	9	1.26
7	Bheel Bhalti	GWD	Aklera	Jhalawar	Dug Well	24.2681	76.4542	359.38	Basalt	B (NC)	10.8	7.8	1.44
8	Bheel Khera	GWD	Aklera	Jhalawar	Dug Well	24.2200	76.3000	387.08	Basalt	B (NC)	10.8	10.7	6.37
9	Borkheri Goojaran	GWD	Aklera	Jhalawar	Dug Well	24.2583	76.4833	367.4	Basalt	B (NC)	12.9	10.85	6.19
10	Chureliya	GWD	Aklera	Jhalawar	Dug Well	24.3167	76.6667	340.17	Basalt	B (NC)	14.1	6.8	5.4
11	Gehoon Kheri	GWD	Aklera	Jhalawar	Dug Well	24.3875	76.4597	328.67	Basalt	B (NC)	14	3.1	2.65
12	Khuri	GWD	Aklera	Jhalawar	Dug Well	24.3742	76.5583	347.78	Basalt	B (NC)	8.61	6.55	4.2
13	Kholi	GWD	Aklera	Jhalawar	Dug Well	24.3236	76.5333	336.29	Basalt	B (NC)	8.9	5.7	4.68
14	Nayagaon	GWD	Aklera	Jhalawar	Dug Well	24.3514	76.4875	338.1	Basalt	B (NC)	17	3.9	4.4
15	Semli 3/115	GWD	Aklera	Jhalawar	Dug Well	24.3361	76.4569	347.56	Basalt	B (NC)	16.5	10.5	1.67
16	Semli Kalan	GWD	Aklera	Jhalawar	Dug Well	24.3500	76.5556	362.19	Basalt	B (NC)	13	9.2	6.31
17	Umariya	GWD	Aklera	Jhalawar	Dug Well	24.2347	76.4028	367.7	Basalt	B (NC)	22	8.75	3.46
18	Aklera	GWD	Aklera	Jhalawar	Dug Well	24.4125	76.5792	332.13	Basalt	B (NC)	15.3	12.5	7.1
19	Ametha	GWD	Aklera	Jhalawar	Dug Well	24.4083	76.4250	338.12	Basalt	B (NC)	16.9	11.3	3.2
20	Anwad	GWD	Aklera	Jhalawar	Dug Well	24.4764	76.4528	332.75	Basalt	B (NC)	8.2	12	4.3
21	Deorideo	GWD	Aklera	Jhalawar	Dug Well	24.2750	76.6250	403.33	Basalt	B (NC)	10.6	2.6	1.84
22	Deorikalan	GWD	Aklera	Jhalawar	Dug Well	24.3458	76.6000	345.95	Basalt	B (NC)	10.6	9.2	7.23
23	Gadia Mahesh	GWD	Aklera	Jhalawar	Dug Well	24.4528	76.4597	337.91	Basalt	B (NC)	9.7	8.8	6.1
24	Jamuniakhurd	GWD	Aklera	Jhalawar	Dug Well	24.4667	76.5042	324.9	Basalt/Shale	B (NC)	10.7	9.6	6.4
25	Katphala	GWD	Aklera	Jhalawar	Dug Well	24.4139	76.4806	324.02	Basalt	B (NC)	12	11.1	3.7
26	Kenwachikalan	GWD	Aklera	Jhalawar	Dug Well	24.4500	76.5708	320.9	Basalt	B (NC)	13	11.3	8.7

27	Lahas	GWD	Aklera	Jhalawar	Dug Well	24.3667	76.6333	332.91	Basalt	B (NC)	11.7	3.1	2.12
28	Lasooriyashah	GWD	Aklera	Jhalawar	Dug Well	24.2722	76.6722	342.77	Basalt	B (NC)	11.9	7.6	4.52
29	Lasooriyashah	GWD	Aklera	Jhalawar	PZ	24.2722	76.6722	349.96	Basalt	B (NC)	60	-	7.26
30	Methoon	GWD	Aklera	Jhalawar	Dug Well	24.4042	76.5042	328.08	Basalt	B (NC)	22	9.4	7.4
31	Mirzapur	GWD	Aklera	Jhalawar	Dug Well	24.4875	76.6458	321.45	Shale&Sandstone	B (NC)	11	9.6	3.8
32	Moreli	GWD	Aklera	Jhalawar	Dug Well	24.4569	76.5500	332.1	Basalt	B (NC)	13.5	dry	5.2
33	Nayagaon Ratanpur	GWD	Aklera	Jhalawar	Dug Well	24.4194	76.4708	330.03	Basalt	B (NC)	11	9.8	5.3
34	Nayagaon Ratanpur Pz	GWD	Aklera	Jhalawar	PZ	24.4194	76.4708	338.56	Basalt	B (NC)	94.5	27.7	28.05
35	Poli	GWD	Aklera	Jhalawar	Dug Well	24.4439	76.4950	320.97	Sandstone	B (NC)	10	6.15	3.5
36	Thanawad	GWD	Aklera	Jhalawar	Dug Well	24.4708	76.4708	319.49	Sandstone	B (NC)	9.7	8.8	3.4
37	Thaural	GWD	Aklera	Jhalawar	Dug Well	24.4075	76.5222	325.2	Basalt	B (NC)	9.3	8.3	8.1
38	Uni	GWD	Aklera	Jhalawar	Dug Well	24.4178	76.5964	321.49	Basalt	B (NC)	16	9.5	9.43
39	Bakani	GWD	Bakani	Jhalawar	Dug Well	24.2958	76.2375	345.36	Basalt	B (NC)	16.5	12.1	4.46
40	Bakani	GWD	Bakani	Jhalawar	PZ	24.2833	76.2403	346.36	Basalt	B (NC)	50	10.8	
41	Banskhoyra	GWD	Bakani	Jhalawar	Dug Well	24.2833	76.2792	375.43	Basalt	B (NC)	9.4	12.5	2.13
42	Baori Khera	GWD	Bakani	Jhalawar	Dug Well	24.3042	76.4167	355.42	Basalt	B (NC)	11.15	9.9	1.75
43	Bhumara	GWD	Bakani	Jhalawar	Dug Well	24.3292	76.1917	340.94	Basalt	B (NC)	21.8	13.1	9.9
44	Chaukri	GWD	Bakani	Jhalawar	Dug Well	24.3889	76.3833	397.57	Basalt	B (NC)	16.8	13.2	4.94
45	Gangpura	GWD	Bakani	Jhalawar	Dug Well	24.2792	76.3056	411.18	Basalt	B (NC)	13.75	12.9	7.48
46	Govindpura	GWD	Bakani	Jhalawar	Dug Well	24.2819	76.3528	418.54	Basalt	B (NC)	13.6	10.45	3.81
47	Jheejhania	GWD	Bakani	Jhalawar	Dug Well	24.3469	76.2353	339.61	Basalt	B (NC)	21.3	17.8	5.6
48	Makhampura	GWD	Bakani	Jhalawar	Dug Well	24.3561	76.3836	335.8	Basalt	B (NC)	13.25	7.4	4.24
49	Motipura	GWD	Bakani	Jhalawar	Dug Well	24.3194	76.2056	375.27	Basalt	B (NC)	9.5	2.9	1
50	Nasirabad	GWD	Bakani	Jhalawar	Dug Well	24.4167	76.2333	341.68	Basalt	B (NC)	16.5	12.4	1.2
51	Nasirabad	GWD	Bakani	Jhalawar	PZ	24.4194	76.2333	334.8	Basalt	B (NC)	30	15.3	9.5
52	Nayagaon Bheelan	GWD	Bakani	Jhalawar	Dug Well	24.3792	76.3611	332.64	Basalt	B (NC)	14.9	13.7	1.8
53	Ratlai	GWD	Bakani	Jhalawar	Dug Well	24.3750	76.3125	340.54	Basalt	B (NC)	10.85	8.9	2.15
54	Reechwa	GWD	Bakani	Jhalawar	Dug Well	24.4583	76.2500	328.65	Sandstone	B (NC)	7.3	8.7	1.85
55	Reechwa	GWD	Bakani	Jhalawar	PZ	24.4583	76.2500	328.65	Sandstone	B (NC)	70	6.9	4.66

56	Salawad	GWD	Bakani	Jhalawar	Dug Well	24.3792	76.2250	336.11	Basalt	B (NC)	16	22.3	9.82
57	Salawad	GWD	Bakani	Jhalawar	PZ	24.3292	75.7958	336.11	Basalt	B (NC)	70	23.75	12.8
58	Soori	GWD	Bakani	Jhalawar	Dug Well	24.3861	76.2694	346.69	Basalt	B (NC)	10.6	12.2	5.85
59	Anwalikalan	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.4417	75.5944	364.66	Basalt	B (NC)	24.5	11.2	8.2
60	Bhawanimandi	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.4125	75.8375	374.29	Basalt	B (NC)	13.95	13.25	3.56
61	Bhilwara	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.5389	76.0500	337.51	Basalt	B (NC)	14.6	11.8	7.85
62	Bhilwara	GWD	Bhawani Mandi	Jhalawar	PZ	24.5389	76.0500	337.51	Basalt	B (NC)	70	15.1	8.94
63	Chorkheri	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.4042	75.9569	319.18	Basalt	B (NC)	15	7.9	7.45
64	Garnawad	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.4750	75.9708	362.57	Basalt	B (NC)	20	10.3	5.3
65	Guradiyajoga	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.3531	75.8364	385.44	Basalt	B (NC)	19	16	15.4
66	Karawan	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.6792	75.8333	396.55	Basalt	B (NC)	21.1	13.6	9.15
67	Mishroli	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.2792	75.8417	400.62	Basalt	B (NC)	15	11.8	2
68	Mogra	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.3500	75.9000	355.02	Basalt	B (NC)	15.2	9.7	5.6
69	Narayankhera	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.4542	75.8042	380.68	Basalt	B (NC)	19	14.3	11.85
70	Pagariya	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.2958	75.8625	407.98	Basalt	B (NC)	21.95	17.9	14.93
71	Peepaliya	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.5264	75.0125	342.95	Basalt	B (NC)	9	7.1	2.95
72	Sarod	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.3292	75.7958	421.55	Basalt	B (NC)	10.95	4.45	4.25
73	Shrichhatarpur	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.5417	75.9417	367.24	Basalt	B (NC)	16.3	10.2	7.34
74	Silahgarh	GWD	Bhawani Mandi	Jhalawar	Dug Well	24.2375	75.8444	386.62	Basalt	B (NC)	18.55	15.7	12.75
75	Arniya	GWD	Dag	Jhalawar	Dug Well	23.5167	75.1958	423.19	Basalt	B (NC)	22.5	16.6	15.68
76	Baman Deoriya	GWD	Dag	Jhalawar	Dug Well	23.8806	75.2625	443.36	Basalt	B (NC)	10	7.8	1.15
77	Bharka 40	GWD	Dag	Jhalawar	Dug Well	21.9361	75.7806	408.19	Basalt	B (NC)	9	6.9	1.9

78	Bharka124	GWD	Dag	Jhalawar	Dug Well	23.9792	75.4875	462.18	Basalt	B (NC)	15.6	13.5	8.9
79	Chara	GWD	Dag	Jhalawar	Dug Well	23.8208	75.6611	432.42	Basalt	B (NC)	14.8	13.1	4.88
80	Dag	GWD	Dag	Jhalawar	Dug Well	23.9292	75.8333	479.14	Basalt	B (NC)	21.85	14.7	7.1
81	Dag	GWD	Dag	Jhalawar	PZ	23.9306	75.8361	498.23	Basalt	B (NC)	85.7	6.55	3.45
82	Dobara	GWD	Dag	Jhalawar	Dug Well	23.8472	75.8972	478.52	Basalt	B (NC)	18.35	2.55	5.2
83	Dobra	GWD	Dag	Jhalawar	PZ	23.9111	75.8986	475.22	Basalt	B (NC)	37	18.2	5.72
84	Dudhaliya	GWD	Dag	Jhalawar	Dug Well	23.5250	75.7833	473.01	Basalt	B (NC)	13.6	7.3	3.51
85	Guwalad	GWD	Dag	Jhalawar	Dug Well	23.9583	75.7042	449.64	Basalt	B (NC)	15.3	9.2	6.42
86	Harnawada	GWD	Dag	Jhalawar	Dug Well	24.0208	75.8750	454.93	Basalt	B (NC)	11	6.9	1.1
87	Kachhnara	GWD	Dag	Jhalawar	Dug Well	23.8500	75.7083	443.2	Basalt	B (NC)	14.15	10.2	6.45
88	Kagariya	GWD	Dag	Jhalawar	PZ	23.8500	75.6292	439.62	Basalt	B (NC)	38	9.7	2.68
89	Karanpura	GWD	Dag	Jhalawar	Dug Well	23.9458	75.6569	433.94	Basalt	B (NC)	11.9	10.3	5.35
90	Koondla	GWD	Dag	Jhalawar	Dug Well	23.9542	75.5042	445.36	Basalt	B (NC)	15.9	13.7	7.75
91	Koondla	GWD	Dag	Jhalawar	PZ	23.9542	75.5156	445.14	Basalt	B (NC)	50	11.7	9.48
92	Parasali	GWD	Dag	Jhalawar	Dug Well	23.9583	75.9417	447.81	Basalt	B (NC)	13.5	7.5	5.82
93	Puwandla	GWD	Dag	Jhalawar	Dug Well	24.0125	75.9028	440.52	Basalt	B (NC)	10.6	9	1.92
94	Rajendrapur Mandi	GWD	Dag	Jhalawar	Dug Well	23.9444	75.6103	424.2	Basalt	B (NC)	12.7	8.1	3.7
95	Ranayara	GWD	Dag	Jhalawar	Dug Well	23.9611	75.5625	445.23	Basalt	B (NC)	16.8	6.6	5.15
96	Sakariya	GWD	Dag	Jhalawar	Dug Well	23.9861	75.6333	430.65	Basalt	B (NC)	9.5	6.7	3.8
97	Sarangakhera	GWD	Dag	Jhalawar	Dug Well	23.9667	75.8694	479.77	Basalt	B (NC)	5.4	3.65	3.95
98	Tajkheri	GWD	Dag	Jhalawar	Dug Well	24.4583	75.7056	437.68	Basalt	B (NC)	11	10	5.1
99	Talawali	GWD	Dag	Jhalawar	Dug Well	23.9042	75.6042	438.31	Basalt	B (NC)	11	8.75	2.87
100	Umariya	GWD	Dag	Jhalawar	Dug Well	24.0083	75.7833	480.44	Basalt	B (NC)	18.5	15.5	8.85
101	Unhel	GWD	Dag	Jhalawar	Dug Well	24.8250	75.5944	437.07	Basalt	B (NC)	19.5	13.5	6.6
102	Bali	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4333	76.1569	348.05	Basalt	B (NC)	9.7	8.9	3.4
103	Dhabli	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4875	76.3667	329.85	Basalt	B (NC)	18.7	11.4	-0.3
104	Dadwara	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5333	76.2792	335.59	Basalt	B (NC)	14.7		7.7
105	Deetyakheri	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4542	76.2167	332.54	Basalt	B (NC)	22.8	15.4	14.3
106	Doonda	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4583	76.1542	345.65	Basalt	B (NC)	15.5	12.3	8.89
107	Doonda	GWD	Jhalrapatan	Jhalawar	PZ	24.4561	76.1533	349.31	Basalt	B (NC)	43.5		35.05
108	Doongargaon	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4333	76.3686	353.78	Basalt	B (NC)	9.6	7.9	6

109	Gadiya	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5125	76.0542	347.11	Basalt	B (NC)	18.5	13.3	6.44
110	Harishpura	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5667	76.0833	333.01	Basalt	B (NC)	14	5.7	5.65
111	Iktasa	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4903	76.2875	326.28	Basalt	B (NC)	11.6	10.5	5.15
112	Khanpuriya	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5500	76.1200	334.05	Basalt	B (NC)	8.65	3.05	6.65
113	Khanpuriya	GWD	Jhalrapatan	Jhalawar	PZ	24.5528	76.1200	336.98	Basalt	B (NC)	62	14.3	2.3
114	Nahardi	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4575	76.1922	329.66	Basalt	B (NC)	7.6	5.9	1.8
115	Panwasa	GWD	Jhalrapatan	Jhalawar	Dug Well	24.3458	76.3083	327.1	Basalt	B (NC)	15	7.1	1.32
116	Piplod	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4667	76.2000	332.07	Basalt	B (NC)	8	6.4	8.89
117	Rooparel	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4958	76.2431	319.92	Basalt	B (NC)	14.4	5.6	2
118	Rooparel	GWD	Jhalrapatan	Jhalawar	PZ	24.4958	76.2431	319.92	Basalt	B (NC)	71	5.8	2.3
119	Rundlao	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4875	76.0889	359.74	Basalt	B (NC)	14.7	13	4.7
120	Teetarwasa	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4694	76.1167	338.85	Basalt	B (NC)	16	10.1	5.4
121	Asnawar	GWD	Jhalrapatan	Jhalawar	PZ	24.4792	76.3292	328.15	Shale & Sandstone	Sh/Ss(NC)	70	8.25	7.4
122	Badiya Gordhanpura	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5097	76.3667	328.53	Shale & Sandstone	Sh/Ss(NC)	13	6	3.3
123	Barodiya	GWD	Jhalrapatan	Jhalawar	Dug Well	24.4328	76.3436	328.53	Sandstone	Sh/Ss(NC)	12.73	9.8	2.9
124	Barodiya	GWD	Jhalrapatan	Jhalawar	PZ	24.4328	76.3436	328.53	Sandstone	Sh/Ss(NC)	70	22.15	4.35
125	Durgpura	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6333	76.1333	312.64	Sandstone	Sh/Ss(NC)	15.2	10.3	2.25
126	Durgpura	GWD	Jhalrapatan	Jhalawar	PZ	24.6333	76.1333	312.64	Sandstone	Sh/Ss(NC)	70	7.1	4.4
127	Gagron	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6250	76.1875	304.37	Sandstone	Sh/Ss(NC)	17	14.1	2.8
128	Jhalawar	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6056	76.1667	329.82	Shale & Sandstone	Sh/Ss(NC)	22.15	24	5.6
129	Jhalawar	GWD	Jhalrapatan	Jhalawar	PZ	24.6056	76.1667	329.82	Shale & Sandstone	Sh/Ss(NC)	101	8.7	7.38
130	Jhalrapatan	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5292	76.1592	337.8	Shale & Sandstone	Sh/Ss(NC)	43	2.4	0.8
131	Jhalrapatan	GWD	Jhalrapatan	Jhalawar	PZ	24.5292	76.1586	326.69	Shale & Sandstone	Sh/Ss(NC)	43	6.7	5.3
132	Jhirniya	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6167	76.1056	325.79	Shale & Sandstone	Sh/Ss(NC)	8.2	5.5	2.15

133	Jhirniya	GWD	Jhalrapatan	Jhalawar	PZ	24.6167	76.1056	325.79	Shale & Sandstone	Sh/Ss(NC)	70	8.1	4.5
134	Kolana	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5917	76.2125	312.21	Shale & Sandstone	Sh/Ss(NC)	9.5	7.7	3.1
135	Khokhanda	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6778	76.1000	320.2	Shale & Sandstone	Sh/Ss(NC)	20	11.3	9.6
136	Mandawar	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5750	76.2458	335.92	Shale & Sandstone	Sh/Ss(NC)	22	12.8	5.8
137	Malipura	GWD	Jhalrapatan	Jhalawar	Dug Well	24.5583	76.1944	322.24	Shale & Sandstone	Sh/Ss(NC)	17.2	14.5	6.5
138	Salotiya	GWD	Jhalrapatan	Jhalawar	Dug Well	24.6264	76.0681	326.83	Shale & Sandstone	Sh/Ss(NC)	12	10.9	3.1
139	Salotiya	GWD	Jhalrapatan	Jhalawar	PZ	24.6264	76.0681	326.83	Shale & Sandstone	Sh/Ss(NC)	64	12.3	5.03
140	Baisar	GWD	Khanpur	Jhalawar	Dug Well	24.7542	76.4208	302.03	Sandstone	Ss(NC)	11	9.7	6.85
141	Baldeopura	GWD	Khanpur	Jhalawar	Dug Well	24.5569	76.4622	328.15	Sandstone	Ss(NC)	27.2	22.1	4.8
142	Bhairoopura	GWD	Khanpur	Jhalawar	PZ	24.5569	76.4622	394.05	Sandstone	Ss(NC)	60	9.2	11.1
143	Bharatpur	GWD	Khanpur	Jhalawar	PZ	24.4833	76.4750	329.28	Shale & Sandstone	Ss(NC)	51.8	14.7	6.93
144	Bhilkhera	GWD	Khanpur	Jhalawar	Dug Well	24.5667	76.5083	310.48	Shale & Sandstone	Ss(NC)	15.1	14.1	6.4
145	Bisankheri	GWD	Khanpur	Jhalawar	PZ	24.7417	76.2542	287.81	Sandstone	Ss(NC)	49.4	17.85	16.95
146	Borda	GWD	Khanpur	Jhalawar	Dug Well	24.2206	76.6533	315.4	Shale & Sandstone	Ss(NC)	17.2	14	3.6
147	Golana	GWD	Khanpur	Jhalawar	Dug Well	24.6875	76.3375	288.16	Shale & Sandstone	Ss(NC)	14.45	9.6	3.7
148	Harigarh	GWD	Khanpur	Jhalawar	Dug Well	24.6583	76.2583	302.69	Sandstone	Ss(NC)	15.6	9.45	8.05
149	Harigarh	GWD	Khanpur	Jhalawar	PZ	24.6561	76.2528	301.65	Sandstone	Ss(NC)	50.75	29.3	10.76
150	Hatola	GWD	Khanpur	Jhalawar	Dug Well	24.6000	76.4875	316.33	Shale & Sandstone	Ss(NC)	16	14.8	9.6
151	Jolpa	GWD	Khanpur	Jhalawar	Dug Well	24.8417	76.3583	288.06	Sandstone	Ss(NC)	22	15.5	9.3
152	Lalawata	GWD	Khanpur	Jhalawar	Dug Well	24.7744	76.2292	280.96	Sandstone	Ss(NC)	8.25	6.1	2.3
153	Layphal	GWD	Khanpur	Jhalawar	PZ	24.7083	76.2417	285.31	Sandstone	Ss(NC)	51.65	17.8	5.35
154	Malanwasa	GWD	Khanpur	Jhalawar	Dug Well	24.5708	76.4208	325.2	Sandstone	Ss(NC)	18.2	7.3	5.4
155	Malanwasa	GWD	Khanpur	Jhalawar	PZ	24.5700	76.4214	323.17	Sandstone	Ss(NC)	67.8	29	27.6
156	Peepalda	GWD	Khanpur	Jhalawar	Dug Well	24.5875	76.3797	304.46	Sandstone	Ss(NC)	17.65	5.3	4.8

157	Piplaj	GWD	Khanpur	Jhalawar	Dug Well	24.7000	76.4167	302.39	Sandstone	Ss(NC)	15.5	10.4	4.8
158	Piplaj	GWD	Khanpur	Jhalawar	PZ	24.7056	76.4217	301.81	Sandstone	Ss(NC)	65.1	16.1	4.6
159	Sarolakhurd	GWD	Khanpur	Jhalawar	PZ	24.6272	76.4250	306.51	Sandstone	Ss(NC)	53	15.65	7.35
160	Seemalkheri	GWD	Khanpur	Jhalawar	PZ	24.6772	76.4103	310.72	Sandstone	Ss(NC)	54.6	31.4	15.1
161	Sewaniya	GWD	Khanpur	Jhalawar	Dug Well	24.5458	76.5250	316.48	Shale & Sandstone	Ss(NC)	13.1	9.3	7.7
162	Soomar	GWD	Khanpur	Jhalawar	PZ	24.7861	76.3861	287.3	Sandstone	Ss(NC)	65.25	35.75	6.19
163	Taraj	GWD	Khanpur	Jhalawar	Dug Well	24.5208	76.4875	324.16	Sandstone	Ss(NC)	21.4	12.9	6.6
164	Ummedpura	GWD	Khanpur	Jhalawar	Dug Well	24.7972	76.2472	279.53	Sandstone	Ss(NC)	11.9	7.8	4.5
165	Ummedpura	GWD	Khanpur	Jhalawar	PZ	24.7964	76.2478	277.69	Sandstone	Ss(NC)	52	8.55	6.4
166	Chalet	GWD	Khanpur	Jhalawar	Dug Well	24.7458	76.2042	286.9	All/Sandstone	Ss(C)	9.7	8.6	4.53
167	Chandpura Chaplara	GWD	Khanpur	Jhalawar	Dug Well	24.6028	76.3694	301.83	All/Sandstone	Ss(C)	14.2	13.15	5.75
168	Dahikhera	GWD	Khanpur	Jhalawar	PZ	24.7694	76.2994	281.28	All/Sandstone	Ss(C)	40.85	6.9	8.4
169	Gadarwala Noorji	GWD	Khanpur	Jhalawar	Dug Well	24.6208	76.3375	299.59	All/Sandstone	Ss(C)	11.1	10.7	3.85
170	Ladaniya	GWD	Khanpur	Jhalawar	PZ	24.6478	76.3111	296.16	All/Sandstone	Ss(C)	22	5.8	6
171	Golana	GWD	Khanpur	Jhalawar	PZ	24.6889	76.3389	289.44	Sandstone	Ss(C)	70	9.11	3.7
172	Anwalhera	GWD	Manoharthana	Jhalawar	Dug Well	24.2458	76.7625	355.02	Basalt	B (NC)	16.45	13.8	4.63
173	Banskhera	GWD	Manoharthana	Jhalawar	Dug Well	24.3167	76.7375	345.2	Basalt	B (NC)	11.15	8.3	5.83
174	Barwad	GWD	Manoharthana	Jhalawar	Dug Well	24.3833	76.6861	336.14	Basalt	B (NC)	15.5	9	4.75
175	Bhoomariya	GWD	Manoharthana	Jhalawar	Dug Well	24.3639	76.7208	337.9	All/Basalt	B (NC)	8.8	9.3	4.75
176	Chhan	GWD	Manoharthana	Jhalawar	Dug Well	24.3181	76.0978	337.88	Basalt	B (NC)	11.9	8.1	5.55
177	Chhitaura	GWD	Manoharthana	Jhalawar	Dug Well	24.1625	76.8792	373.91	Basalt	B (NC)	20	17.4	6.82
178	Dangipura	GWD	Manoharthana	Jhalawar	Dug Well	24.1417	76.8083	382.08	Basalt	B (NC)	11.6	11.7	6.43
179	Dhamahera	GWD	Manoharthana	Jhalawar	Dug Well	24.2875	76.6972	274.07	Basalt	B (NC)	7	6.55	3.42
180	Ganeshpura Barod	GWD	Manoharthana	Jhalawar	Dug Well	24.4069	76.7236	331.38	Basalt	B (NC)	18.6	12.6	6.5
181	Hatai Khera	GWD	Manoharthana	Jhalawar	Dug Well	24.2792	76.7944	-	Basalt	B (NC)	16.7	13.5	12.16
182	Jetpur	GWD	Manoharthana	Jhalawar	Dug Well	24.2583	76.7958	349.93	Basalt	B (NC)	13.3	5.2	2.15
183	Jhiri	GWD	Manoharthana	Jhalawar	Dug Well	24.2694	76.6861	357.78	Basalt	B (NC)	9.2	6	1.13

184	Kamkhera	GWD	Manoharthana	Jhalawar	Dug Well	24.3694	76.6903	334.92	Basalt	B (NC)	16	10.2	5.9
185	Kanwa	GWD	Manoharthana	Jhalawar	Dug Well	24.2028	76.9167	394.78	Basalt	B (NC)	7.9	5.8	4.18
186	Khatakheri	GWD	Manoharthana	Jhalawar	Dug Well	24.1958	76.8125	351.41	All/Basalt	B (NC)	10.8	12	5.65
187	Khatakheri	GWD	Manoharthana	Jhalawar	PZ	24.1958	76.8125	356.09	All/Basalt	B (NC)	60.95	13.2	6.3
188	Kotrakagla	GWD	Manoharthana	Jhalawar	Dug Well	24.4333	76.7514	-	Basalt	B (NC)	7	3.2	2.45
189	Ladpura Balaram	GWD	Manoharthana	Jhalawar	Dug Well	24.2194	76.8528	373.86	Basalt	B (NC)	11.5	8.6	5.85
190	Maharajapura	GWD	Manoharthana	Jhalawar	Dug Well	24.2028	76.6028	413.33	Basalt	B (NC)	5.8	dry	2.85
191	Manpasar	GWD	Manoharthana	Jhalawar	Dug Well	24.2292	76.7069	352.97	Basalt	B (NC)	14.9	11.7	5.12
192	Manoharthana	GWD	Manoharthana	Jhalawar	Dug Well	24.2369	76.8036	343.88	Basalt	B (NC)	18	13.6	6.9
193	Prithipura 3/256	GWD	Manoharthana	Jhalawar	Dug Well	24.3875	76.8458	342.71	All/Basalt	B (NC)	14.1	11.9	4.2
194	Sadala	GWD	Manoharthana	Jhalawar	Dug Well	24.3583	76.7583	341.95	Basalt	B (NC)	12.8	14.6	5.18
195	Samrol	GWD	Manoharthana	Jhalawar	Dug Well	24.2972	76.7972	350.36	Basalt	B (NC)	19	12.1	6.6
196	Sareri	GWD	Manoharthana	Jhalawar	Dug Well	24.3542	76.6708	329.89	Basalt	B (NC)	18	14.1	10.42
197	Semlihat	GWD	Manoharthana	Jhalawar	Dug Well	24.1667	76.9000	386.56	Basalt	B (NC)	9.05	7.35	6.58
198	Tandi	GWD	Manoharthana	Jhalawar	Dug Well	24.3958	76.8028	410.59	Basalt	B (NC)	12	11.2	4.85
199	Azampur	GWD	Pirawa	Jhalawar	Dug Well	24.3708	76.1042	354.39	Basalt	B	9	8.3	5.15
200	Bolyabari	GWD	Pirawa	Jhalawar	Dug Well	24.1000	76.0500	407.71	Basalt	B	12.5	8.2	2.57
201	Dhablakheenchi	GWD	Pirawa	Jhalawar	Dug Well	24.2917	75.9583	375.16	Basalt	B	17.5	14.8	11.3
202	Deochi	GWD	Pirawa	Jhalawar	Dug Well	24.1472	76.1139	388.13	Basalt	B	10.15	9.9	4.47
203	Dharoniya	GWD	Pirawa	Jhalawar	Dug Well	24.1875	76.0875	375.28	Basalt	B	9.9	5.5	2.82
204	Dhatooriakalan	GWD	Pirawa	Jhalawar	Dug Well	24.2111	75.8611	386.59	Alluvium	A	17	13.8	8.6
205	Dola	GWD	Pirawa	Jhalawar	Dug Well	24.2083	76.0417	397.92	Basalt	B	22	12.3	9.7
206	Dubaliya	GWD	Pirawa	Jhalawar	Dug Well	24.3861	76.0528	373.83	Basalt	B	19	16.1	8.6
207	Gelana	GWD	Pirawa	Jhalawar	Dug Well	24.2292	75.8958	387.25	Basalt	B	21.55	7	1.8
208	Gelana	GWD	Pirawa	Jhalawar	PZ	24.2292	75.8958	387.25	Basalt	B	61.5	8.47	2.25
209	Harnawada Gaja	GWD	Pirawa	Jhalawar	Dug Well	24.0444	75.9681	430.74	Basalt	B	12.5	11.8	3.66
210	Hemra	GWD	Pirawa	Jhalawar	Dug Well	24.2583	75.9917	385.98	Basalt	B	22	19.3	14.3
211	Himmatgarh	GWD	Pirawa	Jhalawar	Dug Well	24.2375	76.1125	353.34	Basalt	B	10.7	5.55	4.63
212	Jheekariya	GWD	Pirawa	Jhalawar	Dug Well	24.3014	76.1181	350.57	Basalt	B	9	6.75	2.75
213	Kalitalai	GWD	Pirawa	Jhalawar	Dug Well	24.3083	76.1583	341.42	Basalt	B	12.5	9	9.6
214	Kalotiya	GWD	Pirawa	Jhalawar	Dug Well	24.4042	76.0208	366.65	Basalt	B	13.9	9.3	6.85

215	Koli Khera	GWD	Pirawa	Jhalawar	Dug Well	24.2222	75.9539	400.34	Basalt	B	20.3	18.8	9
216	Kotari	GWD	Pirawa	Jhalawar	Dug Well	24.1667	75.9864	408.1	Basalt	B	21.9	18.5	9.5
217	Mumana	GWD	Pirawa	Jhalawar	Dug Well	24.1792	75.9125	422.04	Basalt	B	28	19.5	8.9
218	Osav	GWD	Pirawa	Jhalawar	Dug Well	24.1667	76.0569	382.77	Basalt	B	20	13.6	4.28
219	Osav	GWD	Pirawa	Jhalawar	PZ	24.1700	76.0542	383.77	Basalt	B	58.15	11.3	1.26
220	Pagariya	GWD	Pirawa	Jhalawar	Dug Well	24.3347	76.0514	386.7	Basalt	B	21.15	18.1	11.28
221	Pirawa	GWD	Pirawa	Jhalawar	Dug Well	24.1625	76.0125	387.5	Basalt	B	9	7.2	3.55
222	Raipur	GWD	Pirawa	Jhalawar	Dug Well	24.3625	76.1817	338.49	Basalt	B	16.2	11.2	7.1
223	Ramaydalpat	GWD	Pirawa	Jhalawar	Dug Well	24.1194	75.9264	412.16	Basalt	B	14.13		10.6
224	Rampuriya	GWD	Pirawa	Jhalawar	Dug Well	24.1069	76.0944	402.13	Alluvium	B	12.44	11.3	4.15
225	Salri	GWD	Pirawa	Jhalawar	Dug Well	24.4167	76.1500	351.96	Basalt	B	17.9	17.1	3.1
226	Samariya	GWD	Pirawa	Jhalawar	Dug Well	24.3417	75.9333	365.52	Basalt	B	20	15.4	6.45
227	Semla	GWD	Pirawa	Jhalawar	Dug Well	24.3056	75.9611	377.1	Basalt	B	18.4	16.2	14.7
228	Sunel	GWD	Pirawa	Jhalawar	Dug Well	24.3708	76.9542	349.82	Basalt	B	12.35		8.02
229	Garnavad	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4772	75.9664	350	All/Basalt			10.6	5.5
230	Aavli kalan	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4406	75.9108	364	Basalt			12.5	9.3
231	Mishroli	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.2783	75.8403	407	Basalt			13.08	5.2
232	Karavan	CGW B KW	Dag	Jhalawar	Dug Well	24.1783	75.8350	392	Basalt			13.65	8
233	Rojhana	CGW B KW	Dag	Jhalawar	Dug Well	23.9524	75.6875		Basalt			8.8	4.9
234	Gudaliya kala	CGW B KW	Dag	Jhalawar	Dug Well	24.0908	75.8672	412	Basalt			8.9	5.3
235	Harnavada	CGW B KW	Dag	Jhalawar	Dug Well	24.0208	75.8744	451	Basalt			7.7	4.85
236	Guvalad	CGW B KW	Dag	Jhalawar	Dug Well	23.9500	75.7200		Basalt			8.3	1.2
237	Gangdhar	CGW B KW	Dag	Jhalawar	Dug Well	23.9300	75.6200		Basalt			12.8	9
238	Bhilwari	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.5361	76.0472	323	Sandstone			11.8	9.03
239	Jhikadiya	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.3958	75.9383	483	Sandstone			11.25	8.22

240	Semla	CGW B KW	Pirawa	Jhalawar	Dug Well	24.3033	75.9675	432	Basalt			23.87	13.85
241	Pirawa	CGW B KW	Pirawa	Jhalawar	Dug Well	24.1622	76.0494	368	Basalt			12.1	7.4
242	Binda	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4153	76.1864	334	Basalt			11.75	8.79
243	Kishanganj chowki	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4828	76.1878	331	Basalt			7.59	2.62
244	Richwa	CGW B KW	Bakani	Jhalawar	Dug Well	24.4606	76.2464	336	Basalt			3.87	1
245	Bakani	CGW B KW	Bakani	Jhalawar	Dug Well	24.3003	76.2428	333	Basalt			11.65	8.3
246	Ratlai	CGW B KW	Bakani	Jhalawar	Dug Well	24.3708	76.3103	350	Basalt			6.92	2.75
247	Aktasa	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4872	76.2983	344	Sandstone			9.64	7.38
248	Doongargaon	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4383	76.3731	346	Shale & Sandstone			4.8	4.05
249	Aasalpur	CGW B KW	Bakani	Jhalawar	Dug Well	24.2711	76.5089	338	Shale & Sandstone			10.43	7.08
250	Aklera	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.4117	76.5781	318	Shale & Sandstone			10.24	10.69
251	Saredi	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.3650	76.6644	321	Shale & Sandstone			12.3	11.86
252	Jhiri	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.2689	76.7289	353	Shale & Sandstone			6.52	1.58
253	Ronwasa	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.2078	76.8942	369	Shale & Sandstone			8.25	
254	Gajwara	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.3336	76.7681	345	Shale & Sandstone			11.58	6.73
255	Gagren	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.6286	76.1814	275	Shale & Sandstone			13.5	5.95
256	Mandawar	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.5739	76.2450	290	Shale & Sandstone			5.95	1.5
257	Chikali	CGW B KW	Khanpur	Jhalawar	Dug Well	24.7978	76.4050	277	Shale & Sandstone			10.2	10.55
258	Khokheda lala	CGW B KW	Manohar thana	Jhalawar	Dug Well	24.4717	76.4900	269	Shale & Sandstone			8.25	
259	Jhalawar	CGW	Jhalra patan	Jhalawar	Dug Well	24.5964	76.1408	319	Shale &			13.6	20.9

		B KW							Sandstone				
260	Bhavanimandi	CGW B KW	Jhalra patan	Jhalawar	Dug Well	24.4117	75.8447	369	All/Basalt			15.8	3.6
261	Poli	CGW B KW	Khanpur	Jhalawar	Dug Well	24.4428	76.4908	331	Shale & Sandstone				6.2

Annexure-II

Exploration data CGWB

S. No.	Location	Coordinates		Type	Year of	Depth	Depth	Zones tapped		Formation	SWL	Disc.	DD	Trans.	Stora.	Chemical Quality			Remarks
		Lat.	Long.	of	cons.	drilled	constr.	(mbgl)		tapped	(m)	(lpm)	(m)	m^2/day	(s)	EC	Cl	F	
				well		(m)	(m)	From	To							mmhos/cm at 25°C	mg/l	mg/l	
1	Raipur	24°21'	76°10'	EW	79-82	48.50	48.50	Naked		Basalt	13.20	189	2.74	249	-	510	14	0.58	One OW
2	Pirawa	24°12'	76°01'	EW	79-82	86.00	86.00	Naked		Basalt	29.06	77	-	-	-	1200	273	2.00	One OW
3	Harigarh	24°45'	76°15'	EW	79-82	33.00	33.00	Naked		Vindhyan Sst.	2.06	240	-	-	-	500	25	0.34	One OW
4	Khanpur	24°48'	76°23'	EW	79-82	77.50	77.50	Naked		Vindhyan Sst.	12.27	444	-	-	-	620	14	-	-
5	Bhakani	24°17'	76°14'	EW	79-82	81.50	81.50	Naked		Vindhyan Sst.	9.49	75	10.89	9.307	-	755	71	0.34	-
6	Bhalta	24°16'	76°26'	EW	79-82	71.00	71.00	Naked		Vindhyan Sst.	4.67	120	7.23	28	-	558	28	1.00	-
7	Asnawar -I	24 28' 40"	76 19'50"	EW	2002-03	150.00	150.00	Naked		Vindhyan S.Stone	30.96	100	-	-	-	1490	341	0.40	
8	Asnawar - II	24 28' 40"	76 19'50"	EW	2002-03	80.00	80.00	Naked		Vindhyan S.Stone	25.73	220	-	-	-	1840	398	0.50	
9	Doongargaon	24 25' 58"	76 22' 35"	EW	2002-03	120.00	120.00	Naked		Basalt & Vindhyan S. Stone	>50.0	Meager	-	-	-				
10	Doongargaon -II	24 25' 58"	76 22' 35"	EW	2003-04	150.00	150.00	Naked		Basalt & s. stone	29.54	negligible	-	-	-				
11	PHED-I (Radi- ke-Balaji)	24 36' 44"	76 10' 10"	EW	2003-04	150.00	150.00	Naked		Vindhyan s.stone	24.14	120	-	-	-	800	114	0.98	
12	Bakani (Gangjhir)	24 17'00"	76 14'00"	EW	2003-04	92.00	92.00	Naked		S.Stone	-	Dry	-	-	-				
13	Mandawar	24 34" 39"	76 15'07"	EW	2003-04	129.90	129.90	Naked		Shale	10.20	260	-	-	-	1115	163	0.25	
14	Jawahar Nagar (Balji-ki-Chhatri)	24 35' 06"	76 10' 25"	EW	2003-04	150.00	150.00	Naked		S.Stone-Shale	59.65	meagre	-	-	-	2710	667	0.25	
15	Panch Kuiya	24 36' 40"	76 10' 10"	EW	2003-04	150.00	150.00	Naked		S.Stone/ Shale	18.40	120	-	-	-	715	64	0.26	

16	PHED Campus	24 34' 44"	76 10' 18"	EW	2003-04	150.00	150.00	Naked		S.Stone/ Shale	23.00	75	-	-	-	800	107	1.00	
17	Asnawar-III	24 28' 40"	76 19'50"	EW	2003-04	150.00	150.00	Naked		S.Stone/ Shale	21.80	30	-	-	-	1850	462	1.00	
18	Lai Bagh (Jhalra Patan)	24 32' 16"	76 10'24"	EW	2003-04	50.00	50.00	Naked		S.Stone	1.00	150	-	-	-	940	114	0.18	
19	Khanpur	24 44' 00"	76 22' 00"	EW	2003-04	90.00	90.00	Naked		Shale	20.60	370	-	-	-	3380	50	0.75	
20	Richwa	24 3V 26"	76 09' 36"	EW	2003-04	150.00	150.00	Naked		Sand stone	1.00	890	-	-	-	180	18	0.30	
21	Mundia Khedi-1	24 31' 26"	76 09' 36"	EW	2003-04	9.70	-			Basalt & s.stone	-		-	-	-				
22	Mundia Khedi- II	24 31'26"	76 09' 36"	EW	2003-04	10.00	-			Basalt & s.stone		-	-	-	-				
23	Sarola Kalan	24 39' 00"	76 23' 00"	EW	2003-04	65.00	65.00	Naked		Shale/ Limestone	14.21	2017	-	-	-	2040	64	1.01	
24	Mandawar	24 35' 00"	76 14' 00"	EW	2003-04	175.00	175.00	Naked		Vindhyans, Sst&Sh	13.90	45		-	-	1115	163	0.25	
25	Badia Gordhanpura	24 30' 49"	76 21' 49"	EW	2003-04	175.00	175.00	Naked		-do-	11.30	Neg.		-	-				
26	Jhalarapatan	24°32'	76°10'	SH	79-82	77.50	-	Naked		Vindhyan Sst.	-	-	-	-	-	4620	1337	0.83	Abandoned due high salinity and poor yield
27	Sri Chattarpur	24°32'	75°56'	SH	79-82	79.00	-	Naked		Vindhyan shale	-	-	-	-	-	1787	199	0.25	Abandoned due to poor yield
28	Aklera	24°25'	76°34'	SH	79-82	81.50	-	Naked		Basalt	-	-	-	-	-	855	71	1.30	-do-
29	Raipur (PZ)	24 22' 00"	24 22' 00"	PZ	2003-04	37.10	37.10	Naked		Basalt	9.50	meager	-	-	-				
30	Gangdhar	23 56' 49"	75 38' 05"	(EW)	2018-19	105.30	105.30	Naked		Basalt	2.72	150				1160	191	0.15	
31	Gangdhar	23 56' 49"	75 38' 05"	(OW)	2018-19	80.90	80.90	Naked		Basalt	2.80	20				1180	199	0.14	
32	Pagariya	24 07' 24"	75 51' 44"	(EW)	2018-19	117.50	117.50	Naked		Basalt	5.15	1000				750	156	0.15	
33	Pagariya	24 07' 24"	75 51' 44"	(OW)	2018-19	117.50	117.50	Naked		Basalt	5.67	714				850	99	1.3	
34	Kayasara	23 59'	75 51'	(EW)	2018-19	77.80	77.80	Naked		Basalt	11.86	910				720	195	0.32	

		04"	37"															
35	Kayasara	23 59' 04"	75 51' 37"	(OW)	2018-19	78.10	78.10	Naked	Basalt	12.04	910				540	64	0.18	
36	Pipaliya kalan	23 57' 45"	75 49' 32"	(EW)	2018-19	113.90	113.90	Naked	Basalt	16.81	378				450	50	0.25	
37	Pipaliya kalan	23 57' 45"	75 49' 32"	(OW)	2018-19	83.90	83.90	Naked	Basalt	16.90	286				460	52	0.20	
38	Banskhedi	24 07' 00"	75 58' 59"	(EW)	2018-19	202.90	202.90	Naked	Basalt & Sst	44.15	133				1620	425	1.80	
39	Banskhedi	24 07' 00"	75 58' 59"	(OW)	2018-19	184.60	184.60	Naked	Basalt & Sst	47.50	100				3100	837	1.1	
40	Aadhakhedi	24 07' 03"	76 03' 46"	EW	2018-19	135.80	135.80	Naked	Basalt & Sst	19.90	40				1650	454	2.8	
41	Baysani	24°18' 30"	75°50' 22"	(EW)	2018-19	87.00	87.00	Naked	Basalt	21.28	108				4550	1290	0.91	
42	Baysani	24°18' 30"	75°50' 22"	(OW)	2018-19	90.00	90.00	Naked	Basalt	22.23	108				4780	1390	0.82	
43	Aanvali kalan	24°26' 21"	75°55' 11"	(EW)	2018-19	48.30	48.30	Naked	Basalt	13.80	40				1410	191	0.8	
44	Jolpa	24°50' 41"	76°21' 15"	(EW)	2018-19	175.40	175.40	Naked	Vindhyans, Sst&Sh	35.70	40							
45	Manpura	24°29' 23"	76°21' 06"	(EW)	2018-19	38.20	38.20	Naked	Basalt	10.05	20							

	Exploration data RGWD												Annexure-III	
S .No	VILLAGE	BLOCK	DISTRICT	BORE TYPE	CENSUSCODE	LONGITUDE	LATITUDE	POINT_X	POINT_Y	AGENCY	BASIN	ID1	TOTAL DEPTH	Aquifer
1	Bor Kheri Goojran	Bakani	JHALAWAR	PZ	0832000304057300	76:28:20.06	24:15:30.27	649453.63	2683625.61	RGWD	CHAMBAL	2619	50.00	Basalt
2	Bor Kheri Goojran	Bakani	JHALAWAR	PZ	0832000304057300	76:28:17.88	24:15:22.50	649394.73	2683386.05	RGWD	CHAMBAL	2620	12.00	Basalt
3	Nasirabad	Bakani	JHALAWAR	PZ	0832000204020500	76:13:55.68	24:24:41.83	624926.42	2700355.24	RGWD	CHAMBAL	2621	30.00	Basalt
4	Basodiya	Bakani	JHALAWAR	PZ	0832000304043300	76:32:16.95	24:23:26.92	655972.42	2698360.77	RGWD	CHAMBAL	2622	33.00	Basalt
5	Sarda	Bakani	JHALAWAR	PZ	0832000304060300	76:32:38.64	24:14:50.86	656759.57	2682492.14	RGWD	CHAMBAL	2623	215.00	Basalt
6	Salawad	Bakani	JHALAWAR	PZ	0832000204024600	76:14:36.45	24:21:32.04	626126.96	2694527.3	RGWD	CHAMBAL	2624	62.00	Basalt
7	Bhalta	Bakani	JHALAWAR	PZ	0832000304052900	76:26:30.69	24:16:20.94	646353.02	2685152.05	RGWD	CHAMBAL	2625	68.00	Basalt
8	Reechhwa	Bakani	JHALAWAR	PZ	0832000204020100	76:14:30.20	24:26:50.50	625862.99	2704321.83	RGWD	CHAMBAL	2626	78.00	Shale
9	Bakani (Ct)	Bakani	JHALAWAR	PZ	0832000243203000	76:14:24.95	24:16:23.14	625887.72	2685022.76	RGWD	CHAMBAL	2627	110.00	Basalt
10	Amrit Kheri	Bakani	JHALAWAR	PZ	0832000304047700	76:31:20.73	24:21:53.75	654420	2695476.96	RGWD	CHAMBAL	2628	35.00	Basalt
11	Asalpur	Bakani	JHALAWAR	PZ	0832000304053800	76:30:44.28	24:16:34.39	653499.51	2685641.69	RGWD	CHAMBAL	2629	30.00	Basalt
12	Ratlai	Bakani	JHALAWAR	PZ	0832000204023600	76:19:00.03	24:21:18.22	633558.29	2694170.57	RGWD	CHAMBAL	2630	205.00	Basalt
13	Parasli	Dag	JHALAWAR	EW	0832000704134500	75:56:46.85	23:57:00.53	596294.02	2649030.2	RGWD	CHAMBAL	2631	100.00	Basalt
14	Koondla	Dag	JHALAWAR	PZ	0832000704119900	75:30:21.31	23:57:23.54	551475.42	2649507.07	RGWD	CHAMBAL	2646	50.00	Basalt
15	Pagariya	Dag	JHALAWAR	PZ	0832000504093100	75:51:41.01	24:07:27.40	587531.06	2668255.09	RGWD	CHAMBAL	2647	124.00	Basalt
16	Silehgarh	Dag	JHALAWAR	PZ	0832000504090600	75:51:04.42	24:14:01.17	586424.56	2680359.83	RGWD	CHAMBAL	2648	41.00	Basalt
17	Kachhnara	Dag	JHALAWAR	PZ	0832000704127800	75:42:04.61	23:51:16.25	571409.35	2638296.39	RGWD	CHAMBAL	2649	35.00	Basalt
18	Unhel	Dag	JHALAWAR	PZ	0832000704126900	75:36:06.32	23:49:21.73	561289.74	2634727.53	RGWD	CHAMBAL	2650	200.00	Basalt
19	Gangdhar	Dag	JHALAWAR	PZ	0832000704118900	75:38:32.06	23:56:31.86	565352.97	2647974.23	RGWD	CHAMBAL	2665	84.00	Basalt
20	Aranya	Dag	JHALAWAR	PZ	0832000704121300	75:32:18.50	23:53:11.14	554817.09	2641757.03	RGWD	CHAMBAL	2666	82.00	Basalt
21	Dag	Dag	JHALAWAR	PZ	0832000704133900	75:50:02.95	23:56:14.38	584885.91	2647538.68	RGWD	CHAMBAL	2667	115.00	Basalt
22	Panwasa	Jhalrapatan	JHALAWAR	EW	0832000204007800	76:17:59.06	24:31:06.19	631670.39	2712240.93	RGWD	CHAMBAL	2668	154.00	Basalt
23	Rooparel	Jhalrapatan	JHALAWAR	OW	0832000204008700	76:14:44.64	24:30:14.16	626213.26	2710590.21	RGWD	CHAMBAL	2669	88.00	Basalt
24	Bhilwara	Jhalrapatan	JHALAWAR	PZ	0832000204002400	76:03:26.24	24:31:18.74	607104.06	2712417.3	RGWD	CHAMBAL	2670	84.00	Basalt
25	Jhalrapatan (M)	Jhalrapatan	JHALAWAR	PZ	0832000243202000	76:09:48.86	24:33:02.96	617844.43	2715709.65	RGWD	CHAMBAL	2671	84.00	Shale
26	Doongar Gaon	Jhalrapatan	JHALAWAR	PZ	0832000204017300	76:22:16.23	24:25:52.47	639003.87	2702660.65	RGWD	CHAMBAL	2672	200.00	Basalt
27	Teetarwasa	Jhalrapatan	JHALAWAR	PZ	0832000204009800	76:07:02.97	24:28:03.14	613251.68	2706448.64	RGWD	CHAMBAL	2673	34.00	Basalt
28	Gagron	Jhalrapatan	JHALAWAR	PZ	0832000203996700	76:11:17.66	24:39:47.39	620235.43	2728171.62	RGWD	CHAMBAL	2674	80.00	Hills
29	Asnawar	Jhalrapatan	JHALAWAR	PZ	0832000204013700	76:19:35.52	24:29:11.23	634419.22	2708730.62	RGWD	CHAMBAL	2675	65.00	Shale

30	Nahardi	Jhalrapatan	JHALAWAR	PZ	0832000204011900	76:11:42.26	24:26:37.52	621137.5	2703880.89	RGWD	CHAMBAL	2676	32.00	Basalt
31	Kanwara	Jhalrapatan	JHALAWAR	PZ	0832000204003900	76:01:59.90	24:27:52.97	604721.65	2706069.49	RGWD	CHAMBAL	2677	152.00	Basalt
32	Dahi Khera	Khanpur	JHALAWAR	PZ	0832000103981900	76:18:17.17	24:46:15.15	631914.58	2740206.87	RGWD	CHAMBAL	2678	70.00	Sandstone
33	Golana	Khanpur	JHALAWAR	PZ	0832000103987900	76:20:59.31	24:41:15.41	636559.52	2731030.42	RGWD	CHAMBAL	2679	70.00	Sandstone
34	Taraj	Khanpur	JHALAWAR	PZ	0832000103995400	76:29:26.80	24:31:39.07	651015.5	2713448.24	RGWD	CHAMBAL	2680	108.00	Sandstone
35	Sarola Kalan	Khanpur	JHALAWAR	PZ	0832000103991800	76:26:10.07	24:37:23.31	645368.68	2723979.2	RGWD	CHAMBAL	2681	100.00	Sandstone
36	Lokat	Khanpur	JHALAWAR	PZ	0832000103987300	76:20:39.66	24:40:56.15	636013.15	2730432.5	RGWD	CHAMBAL	2682	60.00	Sandstone
37	Khanpur	Khanpur	JHALAWAR	PZ	0832000103980800	76:23:04.73	24:43:22.98	640045.07	2734989.95	RGWD	CHAMBAL	2683	68.00	Sandstone
38	Harigarh	Khanpur	JHALAWAR	PZ	0832000103983500	76:15:16.57	24:39:20.97	626958.83	2727418.81	RGWD	CHAMBAL	2684	35.00	Sandstone
39	Ametha	Manohar Thana	JHALAWAR	PZ	0832000304038800	76:26:22.41	24:24:37.12	645961.46	2700412.89	RGWD	CHAMBAL	2685	38.00	Basalt
40	Manoharthana (Ct)	Manohar Thana	JHALAWAR	PZ	0832000443205000	76:48:37.20	24:14:36.02	683803.57	2682360.6	RGWD	CHAMBAL	2686	82.00	Basalt
41	Khata Kheri	Manohar Thana	JHALAWAR	PZ	0832000404076100	76:48:21.66	24:12:37.63	683412.34	2678712.81	RGWD	CHAMBAL	2687	82.00	Basalt
42	Aklera (M)	Manohar Thana	JHALAWAR	EW	0832000343204000	76:34:06.96	24:25:02.94	659038.45	2701349.13	RGWD	CHAMBAL	2688	102.00	Basalt
43	Lahas	Manohar Thana	JHALAWAR	EW	0832000304041600	76:38:12.33	24:23:18.53	665987.95	2698217.1	RGWD	CHAMBAL	2689	105.00	Basalt
44	Azampur	Pirawa	JHALAWAR	PZ	0832000604098500	76:07:25.01	24:21:26.83	613971.14	2694263.66	RGWD	CHAMBAL	2690	37.00	Basalt
45	Hemra	Pirawa	JHALAWAR	PZ	0832000604106200	76:00:01.02	24:15:50.07	601534.87	2683809.79	RGWD	CHAMBAL	2691	37.00	Basalt
46	Pirawa (M)	Pirawa	JHALAWAR	PZ	0832000643207000	76:02:17.57	24:09:37.25	605470.62	2672370.68	RGWD	CHAMBAL	2692	190.00	Basalt
47	Sunel	Pirawa	JHALAWAR	EW	0832000604103100	75:58:03.74	24:22:14.52	598145.49	2695611.37	RGWD	CHAMBAL	2693	138.00	Basalt
48	Raipur	Pirawa	JHALAWAR	EW	0832000604097600	76:10:59.80	24:20:13.70	620042.68	2692064.44	RGWD	CHAMBAL	2694	154.00	Basalt
49	Deochi	Pirawa	JHALAWAR	PZ	0832000604113700	76:06:49.23	24:09:34.84	613137.71	2672355.55	RGWD	CHAMBAL	2695	98.00	Basalt
50	Dola	Pirawa	JHALAWAR	PZ	0832000604107800	76:00:33.15	24:13:25.18	602473.18	2679359.86	RGWD	CHAMBAL	2696	110.00	Basalt
51	Semla	Pirawa	JHALAWAR	PZ	0832000604103900	75:58:29.52	24:18:59.56	598913.98	2689619.8	RGWD	CHAMBAL	2697	110.00	Basalt
52	Kushalpura	Bakani	JHALAWAR	PZ	0832000204030000	76:18:02.85	24:16:23.98	632031.6	2685104.75	RGWD	CHAMBAL	2698	141.00	Basalt
53	Mishroli	Jhalrapatan	JHALAWAR	PZ	0832000504089800	75:50:59.11	24:16:53.42	586242.33	2685656.73	RGWD	CHAMBAL	2699	80.00	Basalt
54	Bhawani Mandi (M)	Jhalrapatan	JHALAWAR	PZ	0832000543206000	75:49:38.84	24:24:03.51	583900.76	2698871.72	RGWD	CHAMBAL	2700	80.00	Basalt
55	Chhatar Pura	Khanpur	JHALAWAR	PZ	0832000103986500	76:20:36.14	24:36:44.44	635989.96	2722688.39	RGWD	CHAMBAL	2701	240.00	Sandstone
56	Dobra	Dag	JHALAWAR	PZ	0832000704135200	75:54:24.22	23:54:08.46	592296.38	2643711.33	RGWD	CHAMBAL	2702	37.00	Basalt
57	Kagariya	Dag	JHALAWAR	PZ	0832000704126700	75:38:14.23	23:50:53.81	564895.96	2637575.34	RGWD	CHAMBAL	2703	38.00	Basalt

Annexure-IV

केन्द्रीय भूमिजल बोर्ड,

क्षेत्रीय रासायनिक प्रयोगशाला

पश्चिमी क्षेत्र,जयपुर

TEST REPORT

Accreditation NABL Certificate No.TC-5898

NABL ISO / IEC 17025 Accredited

Sender : **Sh. S.S Saraswat,Sc D** **Letter No.: Nil** **Receit Date:** **25.6.18**

Test Item- Ground water **Container:** Polyethylene

Lab ID No. 44P/18(1-40) **Quantity:** 1 lt

1. Chemical Testing **Sample Condition:** OK

1. Water

PROTOCOL OF TEST AND METHOD

pH-	APHA 23rd Edition; 4500 H^+ B
EC-	APHA 23rd Edition; 2510 B
Cl-	APHA 23rd Edition; 4500 Cl^- B
F-	APHA 23rd Edition; 4500- F^- D
NO_3^-	APHA23rd Edition; 4500 NO_3^- B

PROTOCOL OF TEST AND METHOD

TH-	APHA 23nd Edition; 2340 C
Ca-	APHA 23rd Edition; 3500 Ca B
Mg-	APHA23rd Edition; 3500 Mg^+ B
Na	APHA 23rd Edition;3500- Na B
K	APHA 23rd Edition;3500 K B

***Parameter under NABL**

Type of Study -NHS/Exploration/**NAQUIM**/Pollution/Others

S.No.	SITE	BLOCK	DISTRICT	Latitude	Longitude	Date of collect.	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*	Fe	TDS
									mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Garnavad	Jhalra Patan	Jhalawar	24.48	75.97	9/6/2018	7.18	5960	Nil	732	1065	930	130	0.17	0.42	1730	284	248	650	46.1	0.97	3874
2	Avali kalan	Jhalra Patan	Jhalawar	24.44	75.91	9/6/2018	7.64	2190	Nil	622	250	200	195	0.95	0.43	650	128	80	275	1.5	0.27	1424
3	Guradia Joga	Jhalra Patan	Jhalawar	24.35	75.83	9/6/2018	7.64	1240	Nil	525	114	30	115	0.62	0.43	550	80	85	80	0.5	4.25	806
4	Mishroli	Jhalra Patan	Jhalawar	24.28	75.84	9/6/2018	7.18	1550	Nil	537	213	10	145	0.25	0.42	710	180	63	75	1.2	0.09	1008
5	Karavan	Dag	Jhalawar	24.18	75.84	9/6/2018	7.2	1960	Nil	634	348	10	95	0.50	0.23	870	124	136	104	6.3	BDL	1274

6	Rojhana	Dag	Jhalawar	23.95	75.69	11/6/2018	7.42	980	Nil	464	135	20	2.8	0.50	0.6	490	120	46	54	2.7	0.03	637
7	Harnavada	Dag	Jhalawar	24.02	75.87	11/6/2018	7.21	1100	Nil	439	121	20	46	0.20	0.4	510	184	12	39	1.2	0.15	715
8	Gangdhar	Dag	Jhalawar	23.93	75.62	11/6/2018	7.2	2390	Nil	891	249	60	220	0.57	0.39	960	100	173	175	1.1	BDL	1554
9	Bhadaka	Dag	Jhalawar	23.94	75.78	11/6/2018	7.14	2250	Nil	866	327	25	16	0.90	0.37	780	196	71	140	113	BDL	1463
10	Bhilwari	Jhalra Patan	Jhalawar	24.54	76.05	11/6/2018	6.9	21600	Nil	268	8768	500	BDL	BDL	0.05	8020	1632	958	2350	20	5.7	14040
11	Jhikadiya	Jhalra Patan	Jhalawar	24.40	75.94	12/6/2018	2.48	4500		acidic sample												
12	Semla	Pirawar	Jhalawar	24.30	75.97	12/6/2018	7.45	1390	Nil	427	170	90	40	1.3	0.36	310	76	29	194	4.0	0.08	904
13	Pirwara	Pirawar	Jhalawar	24.16	76.05	12/6/2018	7.49	800	Nil	281	71	10	90	0.50	0.33	330	64	41	45	0.2	0.06	520
14	Binda	Jhalra Patan	Jhalawar	24.42	76.19	12/6/2018	7.37	1510	Nil	293	99	40	100	0.40	0.26	480	132	36	20	1.1	0.17	982
15	Kishabganj Chowki	Jhalra Patan	Jhalawar	24.48	76.19	12/6/2018	7.4	2000	Nil	427	376	50	BDL	1.25	0.37	340	60	46	280	5.6	3.58	1300
16	Richwa	Bakani	Jhalawar	24.46	76.25	13/6/18	6.35	400	Nil	146	57	0	12	0.075	0.45	130	28	15	42	6	0.08	260
17	Bakani	Bakani	Jhalawar	24.30	76.24	13/6/18	7.53	1000	Nil	403	135	50	45	0.40	0.37	460	88	58	78	1.6	2.95	650
18	Ratlai	Bakani	Jhalawar	24.37	76.31	13/6/18	7.48	1300	Nil	415	178	10	100	0.25	0.51	500	120	49	92	0.1	0.20	845
19	Aktasa	Jhalra Patan	Jhalawar	24.49	76.30	15/6/18	7.59	2900	Nil	110	959	40	BDL	0.48	0.02	300	80	24	550	7.9	0.03	1885
20	Aasalpur	Bakani	Jhalawar	24.27	76.51	15/6/18	7.35	1100	Nil	488	50	15	55	0.52	0.02	460	124	36	40	1.0	0.05	715
21	Aklera	Manohar Thana	Jhalawar	24.41	76.58	15/6/18	6.97	1550	Nil	537	178	50	65	1.17	0.03	490	64	80	152	0.8	0.11	1008
22	Saredi	Manohar Thana	Jhalawar	24.37	76.66	15/6/18	7.36	1315	Nil	683	71	BDL	15	0.40	0.02	460	80	63	100	0.8	0.07	855
23	JHIRI	Manohar Thana	Jhalawar	24.27	76.73	15/6/18	7.03	600	Nil	293	14.2	10	12	0.25	0.02	240	60	22	24	0.7	0.12	390
24	Ganeshpura	Manohar Thana	Jhalawar	24.21	76.87	15/6/18	6.9	870	Nil	195	107	10	35	0.32	0.02	310	92	19	24	0.1	1.52	566
25	Ronwasa	Manohar Thana	Jhalawar	24.21	76.89	15/6/18	7.82	680	Nil	293	64	10	4.0	0.52	0.03	280	72	24	30	1.4	1.15	442
26	Gajwara	Manohar Thana	Jhalawar	24.33	76.77	15/6/18	7.17	1050	Nil	403	71	10	75	0.82	0.03	370	116	19	62	1.8	0.13	683
27	Gagren	Jhalra Patan	Jhalawar	24.63	76.18	16/6/18	7.4	1370	Nil	451	178	40	25	0.70	0.03	550	136	51	67	7.1	0.44	891
28	Mandawar	Jhalra Patan	Jhalawar	24.57	76.25	16/6/18	7.15	4060	Nil	1061	774	100	4.0	0.82	1.57	720	120	102	620	25	BDL	2639
29	Chikali	Khanpur	Jhalawar	24.80	76.41	16/6/18	7.37	1210	Nil	512	71	60	19	0.60	0.03	450	92	54	75	5.9	0.02	787
30	Jolpa	Khanpur	Jhalawar	24.85	76.35	16/6/18	7.5	1215	Nil	415	135	65	42	0.77	0.03	430	80	56	100	4.5	BDL	790
31	Bamgdasiya	Khanpur	Jhalawar	24.85	76.31	16/6/18	7.13	1570	Nil	756	57	8	18	1.28	0.02	250	40	36	220	2.3	1.06	1021
32	Dahikheda	Khanpur	Jhalawar	24.77	76.30	16/6/18	7.68	2115	Nil	781	156	190	23	0.90	0.02	190	32	27	420	3.4	0.45	1375
33	Golana	Khanpur	Jhalawar	24.69	76.34	16/6/18	7.18	2640	Nil	659	327	230	165	0.45	0.02	760	100	124	294	4.9	1.00	1716
34	Khokheda lala	Manohar Thana	Jhalawar	24.47	76.49	17/6/18	7.21	1340	Nil	488	99	50	120	0.42	0.01	500	164	22	92	11.3	BDL	871

35	Taraj	Khanpur	Jhalawar	24.52	76.49	17/6/18	7.15	1100	Nil	427	78	30	80	0.65	0.025	360	104	24	97	3.2	BDL	715
36	Sarola kalan	Khanpur	Jhalawar	24.61	76.43	17/6/18	7.02	1530	Nil	598	121	50	85	0.65	0.01	650	148	68	68	4.6	1.65	995
37	Jhalra Patan	Jhalra Patan	Jhalawar	24.55	76.17	17/6/18	6.95	580	Nil	207	64	15	9.0	0.22	0.02	180	44	17	55	5.6	4.20	377
38	Jhalawar	Jhalra Patan	Jhalawar	24.60	76.14	18/6/18	7.25	715	Nil	281	71	10	BDL	0.325	0.02	220	72	10	60	2.9	2.07	465
39	Bhavanimandi	Jhalra Patan	Jhalawar	24.41	75.84	18/6/18	7.9	1715	Nil	232	454	30	BDL	1.85	0.02	150	20	24	340	4.2	7.46	1115
40	Ralawata	Jhalra Patan	Jhalawar	24.57	76.14	18/6/18	6.98	410	Nil	207	28.4	3	BDL	0.22	0.02	160	32	19.4	21	6.7	8.00	267

Note: **1. The Test results relate only to the sample tested**

2. Results Apply to Sample as received

3.Sample will be destroyed after retention time of 15 days unless specially specified otherwise .

4. BDL (Below Detection Lmit) **5. NSS- No sample submitted**

Analysed by

Dr J.P.Ga **Garg**

Assistant Chemist

Authorised Signatory

Balinder P. Singh
Sc D(Sr. Chemist)

Annexure-V

केन्द्रीय भूमिजल बोर्ड,
क्षेत्रीय रासायनिक
प्रयोगशाला
पश्चिमी क्षेत्र,जयपुर
TEST REPORT

Sender : **Sh. S.S Saraswat,Sc D** **Letter No.: Nil** **Receipt Date: 25.6.18**

Test Item- Ground water **Container:** Polyethylene

Lab ID No. 45P/18(1-11) **Quantity:** 1 lt

1. Chemical Testing **Sample Condition: OK**

1. Water

S.No.	SITE	BLOCK	DISTRICT	Date of collection	Cu	Zn	Ni	Mn	Cd	Pb	Co
					mg/l						
1	Garnavad	Jhalrapatan	Jhalawar	9.6.18	0.013	0.002	0.017	0.005	0.006	0.013	0.016
2	Rojhana	Dag	Jhalawar	11.6.18	0.006	0.001	0.006	0.000	0.000	0.017	0.006
3	Bhilwari	Jhalrapatan	Jhalawar	11.6.18	0.042	0.800	0.076	0.397	0.020	0.001	0.048
4	Jhikadiya	Jhalrapatan	Jhalawar	12.6.18	0.006	0.004	0.005	0.000	0.000	0.152	0.007
5	Binda	Jhalrapatan	Jhalawar	12.6.18	0.021	0.275	0.012	0.008	0.002	0.000	0.010
6	Bakani	Bakani	Jhalawar	13.6.18	0.033	0.474	0.015	0.016	0.002	0.013	0.012
7	Aasalpur	Bakani	Jhalawar	15.6.18	0.007	0.004	0.009	0.000	0.001	0.005	0.012
8	Aklera	Manoharthana	Jhalawar	15.6.18	0.006	0.002	0.009	0.000	0.001	0.009	0.012
9	Gagren	Jhalrapatan	Jhalawar	16.6.18	0.026	0.072	0.010	0.004	0.002	0.017	0.011

10	Chikali	khanpur	Jhalawar	16.6.18	0.026	0.170	0.009	0.003	0.000	0.009	0.009
11	Bhavanimandi	Jhalrapatan	Jhalawar	16.6.18	0.026	0.260	0.007	0.034	0.000	0.000	0.007

Note: **1. The Test results relate only to the sample tested**

2. Results Apply to Sample as received

3.Sample will be destroyed after retention time of 15 days unless specially specified otherwise .

4. BDL (Below Detection Lmit) **5. NSS- No sample submitted**

Analysed by

Dr.J.P.Garg
Assistant Chemist

Authorised Signatory
Balinder P. Singh
Sc D(Sr. Chemist)

Annexure-VI

केन्द्रीय भूमिजल बोर्ड,

क्षेत्रीय रासायनिक प्रयोगशाला

पश्चिमी क्षेत्र,जयपुर

TEST REPORT

Accreditation NABL Certificate No.TC-5898

Sender : **Sh. S.S Saraswat,Sc D** **Letter No.: Nil** **Receipt Date:** 23.10.18 & 21.12.18

Container : Polyethylene

Quantity: 1 lt

Sample Condition: OK

Test Item- Ground water

Lab ID No. 93P/18(1-12), 121P/18(1-31)

1. Chemical Testing

1. Water

PROTOCOL OF TEST AND METHOD

pH-	APHA 23rd Edition; 4500 H^+ B		
EC-	APHA 23rd Edition; 2510 B		
Cl-	APHA 23rd Edition; 4500 Cl^- B		
F-	APHA 23rd Edition; 4500- F^- D		
NO_3^-	APHA23rd Edition; 4500 NO_3^- B		

PROTOCOL OF TEST AND METHOD

TH-	APHA 23nd Edition; 2340 C
Ca-	APHA 23rd Edition; 3500 Ca B
Mg-	APHA23rd Edition; 3500 Mg^+ B
Na	APHA 23rd Edition;3500- Na B
K	APHA 23rd Edition;3500 K B

***Parameter under NABL**

Type of Study -NHS/Exploration/**NAQUIM**/Pollution/Others

S.No.	SITE	BLOCK	DISTRICT	Latitude	Longitude	Date of collect.	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*	Fe	TDS
									mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	Pagariya	Dag	Jhalawar	24.12	75.86	16.10.18	7.2	1760	Nil	622	270	20	130	0.46	0.10	690	144	80	154	0.50	0.30	1144
2	Gangdhar	Dag	Jhalawar	24.09	75.87	16.10.18	7.67	1850	Nil	671	170	70	100	0.75	0.32	400	60	61	180	136	1.20	1203

3	Guwalad	Dag	Jhalawar	23.95	75.71	16.10.18	7.53	1410	Nil	488	163	30	75	0.57	0.18	540	148	41	89	5.7	0.25	917
4	Bhadaka	Dag	Jhalawar	23.94	75.78	16.10.18	7.09	2270	Nil	756	276	20	190	0.67	0.04	730	176	70	130	144	1.10	1476
5	Harnavada	Dag	Jhalawar	24.02	75.87	16.10.18	7.27	1934	Nil	439	178	200	200	0.72	0.19	800	184	83	90	0.5	NSS	1257
6	Karavan	Dag	Jhalawar	24.18	75.83	16.10.18	7.26	2700	Nil	586	398	100	298	0.87	0.99	1010	156	150	170	17.4	NSS	1755
7	Mishroli	J.Patan	Jhalawar	24.28	75.84	16.10.18	7.56	1700	Nil	512	220	10	160	0.82	0.53	660	148	70	100	1.3	0.28	1105
8	Gurdiya Joga	J.Patan	Jhalawar	24.35	75.83	16.10.18	7.43	1480	Nil	512	121	100	114	1.10	0.25	600	88	92	93	0.5	0.45	962
9	Bhawani mandi	J.Patan	Jhalawar	24.41	75.84	17.10.18	7.8	1400	Nil	561	120	70	110	0.80	0.2	630	76	107	85	0.4	0.15	910
10	Avali kalan	J.Patan	Jhalawar	24.44	75.91	17.10.18	7.48	3000	Nil	561	340	460	170	0.80	0.3	990	200	119	275	1.0	0.18	1950
11	Garnavad	J.Patan	Jhalawar	24.48	75.97	17.10.18	7.4	5500	Nil	756	809	880	273	0.70	0.34	1220	216	165	760	47	0.15	3575
12	Pagariya	Dag	Jhalawar	24.12	75.86	16.10.18	7.75	850	Nil	268	99	100	5.0	1.30	0.17	310	40	51	85	1.1	0.36	553
13	Ralawata	J.Patan	Jhalawar	24.57	76.14	Dec-18	7.26	420	Nil	183	21	38	1.4	0.99	0.01	200	32	29	8.0	5.9	11	273
14	Bhilwari	J.Patan	Jhalawar	24.54	76.05	Dec-18	7.02	14330	Nil	390	4892	84	64	BDL	0.01	3840	336	730	1610	15	4.5	9315
15	Bhilwari	J.Patan	Jhalawar	24.54	76.05	Dec-18	8.02	1130	Nil	586	56	118	65	1.00	0.02	500	80	73	110	0.3	BDL	735
16	Jhikadiya	J.Patan	Jhalawar	24.40	75.94	Dec-18	8.34	1220	Nil	610	64	246	35	1.07	0.02	600	64	107	150	2.7	0.10	793
17	Semla	Pirawar	Jhalawar	24.30	75.97	Dec-18	8.18	1232	Nil	549	92	102	60	1.05	BDL	410	64	61	150	1.8	BDL	801
18	Pirawa	Pirawar	Jhalawar	24.16	76.05	Dec-18	8.00	716	Nil	256	50	100	80	0.48	BDL	410	96	41	20	0.4	BDL	465
19	Kali Talai	Pirawar	Jhalawar	24.31	76.16	Dec-18	8.21	840	Nil	317	92	141	14	0.45	BDL	200	44	22	160	1.8	0.30	546
20	Binda	J.Patan	Jhalawar	24.42	76.19	Dec-18	7.78	1050	Nil	305	128	94	60	0.40	BDL	510	152	32	30	1.4	0.60	683
21	Kishanganj	J.Patan	Jhalawar	24.48	76.19	Dec-18	7.98	1670	Nil	439	177	243	BDL	0.82	BDL	340	116	12	240	4.5	3.50	1086
22	Richwa	Bakani	Jhalawar	24.46	76.25	Dec-18	7.06	260	Nil	122	14	17	14	0.27	BDL	130	40	7.0	8.0	4.0	9.00	169
23	Bakari	Bakani	Jhalawar	24.30	76.24	Dec-18	8.13	850	Nil	354	50	70	60	0.30	BDL	440	92	51	20	0.5	0.20	553
24	Ratlai	Bakani	Jhalawar	24.37	76.31	Dec-18	8.10	1130	Nil	354	149	158	30	0.47	BDL	530	88	75	75	0.5	BDL	735
25	Jhalra Patan	J.Patan	Jhalawar	24.54	76.17	Dec-18	7.42	670	Nil	195	64	60	70	0.62	BDL	250	68	19	52	9.0	4.10	436
26	Aktasha	J.Patan	Jhalawar	24.49	76.30	Dec-18	7.95	1840	Nil	488	290	170	110	0.95	BDL	550	120	61	240	5.5	BDL	1196

27	Asalpur	Bakani	Jhalawar	24.27	76.51	Dec-18	8.69	1365	30	720	21	37	5.0	1.00	BDL	170	20	29	250	3.3	0.10	887
28	Aklera	M.Jhana	Jhalawar	24.41	76.58	Dec-18	7.92	1450	Nil	525	184	42	60	1.47	BDL	460	64	73	150	1.1	BDL	943
29	Saredi	M.Jhana	Jhalawar	24.36	76.66	Dec-18	8.17	1224	Nil	610	35	64	65	0.82	BDL	540	60	95	60	1.0	BDL	796
30	Ruiri	M.Jhana	Jhalawar	24.27	76.73	Dec-18	8.47	482	24	134	42	65	BDL	1.07	BDL	180	12	36	46	2.0	BDL	313
31	Gorboliya	M.Jhana	Jhalawar	24.23	76.78	Dec-18	7.70	1660	Nil	634	120	105	105	0.30	BDL	820	104	136	30	1.0	0.60	1079
32	Gajwara	M.Jhana	Jhalawar	24.33	76.77	Dec-18	7.92	1095	Nil	427	50	105	55	0.55	BDL	510	136	41	31	1.0	BDL	712
33	Poli	Khaupur	Jhalawar	24.44	76.49	Dec-18	7.84	620	Nil	256	28	32	80	0.70	BDL	310	88	22	18	0.8	0.20	403
34	Chikali	Khaupur	Jhalawar	24.80	76.40	Dec-18	7.64	1280	Nil	402	106	188	50	0.40	BDL	480	176	10	104	8.2	BDL	832
35	Kanwaspura	Khaupur	Jhalawar	24.81	76.38	Dec-18	7.88	1170	Nil	525	21	161	13	0.77	BDL	390	68	54	112	5.0	BDL	761
36	Jogadi	Khaupur	Jhalawar	24.88	76.31	Dec-18	8.14	550	Nil	317	21	45	12	0.70	BDL	250	52	29	44	3.7	BDL	358
37	Monkhurd	Khaupur	Jhalawar	24.86	76.32	Dec-18	7.82	1650	Nil	488	170	167	150	0.77	BDL	570	88	85	111	100	BDL	1073
38	Dahikhurd	Khaupur	Jhalawar	24.77	76.30	Dec-18	8.22	2300	Nil	634	142	693	17	2.70	BDL	420	36	80	480	1.8	2.80	1495
39	Gadarwala	Khaupur	Jhalawar	24.73	76.37	Dec-18	7.99	1680	Nil	586	50	284	7.0	1.40	BDL	540	68	90	145	2.1	5.00	1092
40	Golana	Khaupur	Jhalawar	24.69	76.34	Dec-18	7.87	1910	Nil	647	128	296	60	0.88	BDL	540	56	97	240	8.5	BDL	1242
41	Mandawar	J.Patan	Jhalawar	24.57	76.24	Dec-18	7.82	2625	Nil	720	368	337	95	1.55	BDL	840	172	100	320	4.6	0.20	1706
42	Jhalawar	J.Patan	Jhalawar	24.60	76.14	Dec-18	7.40	1425	Nil	476	177	142	60	0.40	BDL	630	120	80	95	2.1	BDL	926
43	Gagren	J.Patan	Jhalawar	24.63	76.18	Dec-18	7.75	1350	Nil	378	99	283	18	0.98	BDL	370	112	22	175	9.2	0.30	878

Note :

1. The Test results relate only to the sample tested

2. Results Apply to Sample as received

3.Sample will be destroyed after retention time of 15 days unless specially specified otherwise .

4. BDL (Below Detection Lmit) **5. NSS- No sample submitted**

Analysed by

Dr.J.P.Garg
Assistant Chemist

Authorised Signatory

Balinder P. Singh
Sc D(Sr. Chemist)

Annexure-VII

Lithologs of Exploratory wells

Bore	Depth1	Depth2	Lithology	Agency
AKLERA	0	6	Top soil	GWD
AKLERA	6	15	Weathered Basalt	GWD
AKLERA	15	33	Compact Basalt	GWD
AKLERA	33	102	Compact Sandstone	GWD
AMETHA	0	10	Weathered Basalt	GWD
AMETHA	10	38	Compact Basalt	GWD
AMRAT KHERI	0	12	Weathered Basalt	GWD
AMRAT KHERI	12	35	Compact Basalt	GWD
ARNIA	0	30	Weathered Basalt	GWD
ARNIA	30	82	Compact Sandstone	GWD
ASALPUR	0	15	Weathered Basalt	GWD
ASALPUR	15	24	Compact Basalt	GWD
ASALPUR	24	30	Compact Sandstone	GWD
ASNAWAR	0	6.1	Top soil	CGWB
ASNAWAR	6.1	36.6	Weathered Shale	CGWB
ASNAWAR	36.6	125	Compact Sandstone	CGWB
ASNAWAR	125	131	Compact Shale	CGWB
ASNAWAR	131	150	Compact Sandstone	CGWB
AZAMPUR THEEKRIYA	0	27	Weathered Basalt	GWD
AZAMPUR THEEKRIYA	27	37	Compact Basalt	GWD
BAKANI	0	10	Top soil	GWD
BAKANI	10	20	Weathered Sandstone	GWD
BAKANI	20	110	Compact Sandstone	GWD
BARODIYA	0	3	Top soil	GWD
BARODIYA	3	9	Weathered Shale	GWD

BARODIYA	9	27	Weathered Sandstone	GWD
BARODIYA	27	33	Compact Shale	GWD
BHALTA	0	2	Top soil	CGWB
BHALTA	2	12	Weathered Shale	CGWB
BHALTA	12	24	Weathered Sandstone	CGWB
BHALTA	12	71	Compact Sandstone	CGWB
BHAWANI MANDI	0	1	Top soil	GWD
BHAWANI MANDI	1	57	Weathered Basalt	GWD
BHAWANI MANDI	57	80	Compact Basalt	GWD
BHILWARI	0	6	Top soil	GWD
BHILWARI	21	84	Compact Shale	GWD
BORKHERI GOOJARAN	0	9	Top soil	GWD
BORKHERI GOOJARAN	9	15	Weathered Basalt	GWD
BORKHERI GOOJARAN	15	18	Weathered Shale	GWD
BORKHERI GOOJARAN	18	45	Weathered Sandstone	GWD
BORKHERI GOOJARAN	45	50	Compact Sandstone	GWD
DAG	0	3	Top soil	GWD
DAG	3	115	Compact Basalt	GWD
DEOCHI	0	24	Weathered Basalt	GWD
DEOCHI	24	98	Compact Basalt	GWD
DHAIKHEDA	0	7.5	Top soil	GWD
DHAIKHEDA	7.5	24	Compact Shale	GWD
DHAIKHEDA	24	70	Compact Sandstone	GWD
DOBRA	0	15	Weathered Basalt	GWD
DOBRA	15	37	Compact Basalt	GWD
DOLA	0	40	Weathered Basalt	GWD
DOLA	40	110	Compact Basalt	GWD
DOONGAR GAON	0	9.65	Top soil	CGWB
DOONGAR GAON	9.65	58.45	Compact Basalt	CGWB

DOONGAR GAON	58.45	150	Compact Sandstone	CGWB
GAGRON	0	3	Top soil	GWD
GAGRON	3	15	Compact Shale	GWD
GAGRON	15	17	Weathered Sandstone	GWD
GAGRON	17	80	Compact Shale	GWD
GANGDHAR	0	15	Weathered Basalt	GWD
GANGDHAR	15	84	Compact Basalt	
GANGJHIR	0	9.1	Top soil	CGWB
GANGJHIR	9.1	92	Compact Sandstone	CGWB
GOLANA	0	9	Top soil	GWD
GOLANA	9	15	Weathered Basalt	GWD
GOLANA	15	50	Weathered Sandstone	GWD
GOLANA	50	70	Compact Sandstone	GWD
HARIGARH	0	6	Top soil	GWD
HARIGARH	6	35	Compact Sandstone	GWD
HEMRA	0	6	Top soil	GWD
HEMRA	6	9	Compact Shale	GWD
HEMRA	9	33	Weathered Basalt	GWD
HEMRA	33	37	Compact Basalt	GWD
JAWAHAR	0	9.5	Top soil	CGWB
JAWAHAR	9.5	21.7	Compact Sandstone	CGWB
JAWAHAR	21.7	150	Compact Shale	CGWB
JHALRAPATAN	0	5	Top soil	CGWB
JHALRAPATAN	5	30	Weathered Basalt	CGWB
JHALRAPATAN	30	77.5	Compact Sandstone	CGWB
KACHNARA	0	21	Weathered Basalt	GWD
KACHNARA	21	35	Compact Basalt	GWD
KAGRIYA	0	5	Weathered Basalt	GWD
KAGRIYA	5	38	Compact Basalt	GWD
KANWARA	0	6	Top soil	GWD

KANWARA	6	15	Weathered Basalt	GWD
KANWARA	15	102	Weathered Shale	GWD
KANWARA	102	152	Compact Shale	GWD
KHANPUR	0	7	Top soil	GWD
KHANPUR	7	68	Compact Shale	GWD
KHANPURIYA	0	6	Weathered Basalt	GWD
KHANPURIYA	6	15	Weathered Basalt	GWD
KHANPURIYA	15	18	Weathered Shale	GWD
KHANPURIYA	18	30	Compact Sandstone	GWD
KHATA KHERI	0	18	Top soil	GWD
KHATA KHERI	18	82	Compact Basalt	GWD
KUNDLA	0	6	Compact Basalt	GWD
KUNDLA	6	27	Weathered Basalt	GWD
KUNDLA	27	50	Compact Basalt	GWD
KUSHALPURA	0	6	Top soil	GWD
KUSHALPURA	6	48	Weathered Basalt	GWD
KUSHALPURA	48	132	Compact Basalt	GWD
KUSHALPURA	132	135	Weathered Shale	GWD
KUSHALPURA	135	141	Compact Sandstone	GWD
LAHAS	0	6	Top soil	GWD
LAHAS	6	15	Weathered Basalt	GWD
LAHAS	15	48	Compact Basalt	GWD
LAHAS	48	51	Compact Shale	GWD
LAHAS	51	105	Compact Sandstone	GWD
LALBAGH	0	3.5	Top soil	CGWB
LALBAGH	3.5	50	Compact Sandstone	CGWB
LUKAT	0	15	Top soil	GWD
LUKAT	15	18	Compact Shale	GWD
LUKAT	18	60	Compact Sandstone	GWD
MANOHAR THANA	0	42	Weathered Basalt	GWD

MANOHAR THANA	42	82	Compact Basalt	GWD
MISROLI	0	7	Top soil	GWD
MISROLI	7	80	Compact Basalt	GWD
NAHARDI	0	3	Top soil	GWD
NAHARDI	3	12	Weathered Shale	GWD
NAHARDI	12	32	Compact Shale	GWD
NASIRABAD	0	13	Weathered Basalt	GWD
NASIRABAD	13	30	Compact Basalt	GWD
PAGARIYA	0	24	Weathered Basalt	GWD
PAGARIYA	24	124	Compact Basalt	GWD
PANCH KUIYA	0	12.6	Weathered Sandstone	CGWB
PANCH KUIYA	12.6	150	Compact Sandstone	CGWB
PANWASA	0	3	Top soil	GWD
PANWASA	3	33	Weathered Basalt	GWD
PANWASA	33	36	Compact Basalt	GWD
PANWASA	36	154	Compact Shale	GWD
PARASLI	0	12	Top soil	GWD
PARASLI	12	25	Weathered Basalt	GWD
PARASLI	25	100	Compact Basalt	GWD
PHED CAMPUS	0	15.6	Top soil	CGWB
PHED CAMPUS	15.6	98	Weathered Sandstone	CGWB
PHED CAMPUS	98	122.4	Compact Sandstone	CGWB
PHED CAMPUS	122.4	150	Compact Shale	CGWB
PIRAWA	0	66	Weathered Basalt	GWD
PIRAWA	66	117	Compact Basalt	GWD
PIRAWA	117	168	Weathered Shale	GWD
PIRAWA	168	190	Compact Sandstone	GWD
RADI KE BALAJI	0	6.6	Weathered Sandstone	CGWB
RADI KE BALAJI	6.6	37.1	Compact Sandstone	CGWB

RADI KE BALAJI	37.1	49.3	Compact Shale	CGWB
RADI KE BALAJI	49.3	150	Compact Sandstone	CGWB
RAIPUR	0	6	Top soil	GWD
RAIPUR	6	36	Weathered Basalt	GWD
RAIPUR	36	108	Compact Shale	GWD
RAIPUR	108	126	Compact Sandstone	GWD
RAIPUR	126	154	Compact Sandstone	GWD
RATLAI	0	6	Top soil	GWD
RATLAI	6	18	Weathered Basalt	GWD
RATLAI	18	57	Compact Basalt	GWD
RATLAI	57	105	Weathered Shale	GWD
RATLAI	105	114	Compact Shale	GWD
RATLAI	114	205	Compact Sandstone	GWD
RICHAWA	0	3	Top soil	GWD
RICHAWA	3	24	Weathered Sandstone	GWD
RICHAWA	24	78	Compact Sandstone	GWD
RUPAREL	0	4.5	Top soil	GWD
RUPAREL	4.5	14	Weathered Basalt	GWD
RUPAREL	14	50	Weathered Shale	GWD
RUPAREL	50	68	Compact Shale	GWD
RUPAREL	68	88	Compact Sandstone	GWD
SALAWAD (I)	0	18	Weathered Basalt	GWD
SALAWAD (I)	18	33	Compact Basalt	GWD
SALAWAD (I)	33	57	Weathered Shale	GWD
SALAWAD (I)	57	62	Compact Shale	GWD
SARDA	0	72	Weathered Basalt	GWD
SARDA	72	120	Compact Basalt	GWD
SARDA	120	215	Compact Shale	GWD
SAROD	0	36	Weathered Basalt	GWD
SAROD	36	108	Compact Basalt	GWD

SAROD	108	200	Compact Shale	GWD
SAROLLA KALAN	0	15	Top soil	GWD
SAROLLA KALAN	15	75	Compact Sandstone	GWD
SAROLLA KALAN	75	87	Compact Shale	GWD
SAROLLA KALAN	87	100	Compact Sandstone	GWD
SEMLIA	0	3	Top soil	GWD
SEMLIA	3	35	Weathered Basalt	GWD
SEMLIA	35	110	Compact Basalt	GWD
SHRI CHHATARPURA	0	24	Weathered Basalt	GWD
SHRI CHHATARPURA	24	39	Compact Basalt	GWD
SHRI CHHATARPURA	39	48	Compact Sandstone	GWD
SHRI CHHATARPURA	48	240	Compact Shale	GWD
SILAHGARH	0	3	Top soil	GWD
SILAHGARH	3	15	Weathered Basalt	GWD
SILAHGARH	15	41	Compact Basalt	GWD
SUNEL	0	3	Top soil	GWD
SUNEL	3	54	Weathered Basalt	GWD
SUNEL	54	138	Compact Basalt	GWD
TARAJ	0	6	Weathered Basalt	GWD
TARAJ	6	24	Weathered Shale	GWD
TARAJ	24	108	Compact Sandstone	GWD
TEETARWASA	0	3	Top soil	GWD
TEETARWASA	3	21	Weathered Basalt	GWD
TEETARWASA	21	27	Compact Basalt	GWD
TEETARWASA	27	34	Compact Shale	GWD
UNHEL	0	6	Weathered Basalt	GWD
UNHEL	6	180	Compact Basalt	GWD
UNHEL	180	200	Compact Sandstone	GWD
Gangdhar	0	1.6	Top soil	CGWB
Gangdhar	1.6	44.3	Weathered Basalt	CGWB

Gangdhar	44.3	53.4	Red balls/ clays	CGWB
Gangdhar	53.4	62.6	compact basalt	CGWB
Gangdhar	62.6	87	compact basalt with clays	CGWB
Gangdhar	87	90	Red balls/ clays	CGWB
Gangdhar	90	99.2	compact basalt with clays	CGWB
Gangdhar	99.2	105.3	Red balls/ clays	CGWB
Pagariya	0	4.6	Top soil	CGWB
Pagariya	4.6	13.8	weathered Basalt	CGWB
Pagariya	13.8	68.7	Fractured basalt	CGWB
Pagariya	68.7	74.8	Red balls/ clays	CGWB
Pagariya	74.8	117	Fractured basalt	CGWB
Pagariya	117	117.5	Red balls/ clays	CGWB
Kayasara	0	4.6	Top soil	CGWB
Kayasara	4.6	13.8	Weathered basalt	CGWB
Kayasara	13.8	77.5	Fractured basalt	CGWB
Kayasara	77.5	77.95	Green balls/clays	CGWB
Pipaliya kalan	0	4.6	Top soil	CGWB
Pipaliya kalan	4.6	94.6	Fractured basalt	CGWB
Pipaliya kalan	94.6	113.9	compact basalt with clays	CGWB
Banskhedi	0	7.7	Top soil	CGWB
Banskhedi	7.7	38.2	compact basalt with clays	CGWB
Banskhedi	38.2	132.7	Fractured basalt	CGWB
Banskhedi	132.7	135.8	Green balls/clays	CGWB
Banskhedi	135.8	154.1	Fractured basalt	CGWB
Banskhedi	154.1	184.6	sandstone	CGWB
Aadhakhedi	0	1.6	Top soil	CGWB
Aadhakhedi	1.6	129.7	Fractured basalt	CGWB
Aadhakhedi	129.7	135.8	compact basalt with clays	CGWB
Baysani	0	1.6	Top soil	CGWB
Baysani	1.6	19.9	Weathered basalt	CGWB

Baysani	19.9	83.9	Fractured basalt	CGWB
Baysani	83.9	87	Red balls/ clays	CGWB
Aanvali kalan	0	1.6	Top soil	CGWB
Aanvali kalan	1.6	26	Weathered basalt with clays	CGWB
Aanvali kalan	26	47.3	Fractured basalt	CGWB
Aanvali kalan	47.3	48.3	Green balls/clays	CGWB
Jolpa	0	7.7	Top soil	CGWB
Jolpa	7.7	13.8	sandstone	CGWB
Jolpa	13.8	19.9	Shale	CGWB
Jolpa	19.9	44.3	sandstone	CGWB
Jolpa	44.3	50.4	Shale	CGWB
Jolpa	50.4	62.6	sandstone	CGWB
Jolpa	62.6	80.9	Shale	CGWB
Jolpa	80.9	105.3	sandstone	CGWB
Jolpa	105.3	117.5	Shale	CGWB
Jolpa	117.5	175.4	sandstone	CGWB
Manpura	0	4.6	Top soil	CGWB
Manpura	4.6	22.9	Weathered basalt	CGWB
Manpura	22.9	32.1	compact basalt with clays	CGWB
Manpura	32.1	35.1	Fractured basalt	CGWB

Annexure-VIII

Cumulative Recharge structures constructed in Jhalawar district during three phases of MJSA

Sr. No	Structures	Aklera	Bakani	Bhavani mandi	Dag	Jhalra patan	Khanpur	M.Thana	Pirawa	Total district
1	Anicut	22	48	50	90	48	33	43	50	**384**
2	Earthen check dam (ECD)	0	1	0	1	1	0	0	0	**3**
3	Micro storage tank	7	6	3	5	2	2	7	10	**42**
4	Mini percolation tank	143	16	91	200	54	35	298	248	**1085**
5	MPT	363	330	100	85	88	25	4	60	**1055**
6	Pakka check dam	53	55	52	44	47	40	36	31	**358**
7	Percolation Tank	23	2	6	3	8	0	8	12	**62**
8	Recharging shaft	23	15	3	2	2	4	1	4	**54**
9	Sunkhen pond, Talai (Talab)	64	5	8	52	20	14	16	70	**249**
10	W. harvesting structure	16	0	8	0	3	0	0	4	**31**
11	Minor Irrigation tank	0	2	6	0	0	0	1	2	**11**
12	Sub surface barrier	0	0	0	2	0	0	0	0	**2**
	Total	**714**	**480**	**327**	**484**	**273**	**153**	**414**	**491**	**3336**