

DISTRICT GROUND WATER INFORMATION BOOKLET



JHABUA DISTRICT MADHYA PRADESH



Ministry of Water Resources
Central Ground Water Board
North Central Region
BHOPAL
2013

JHABUA DISTRICT AT A GLANCE

S.No.	Items	Statistics	
1.	General Information		
	i) Geographical area	346000 (Ha)	
	ii) Administrative Divisions (As on 2013)		
	Number of Tehsil/Blocks	8/12	
	Number of Villages	818	
iii) Population (Census 2011)	1,024,091		
iv) Normal Rainfall (mm)	855.5		
2.	Geomorphology		
	1. Major Physiographic Units:	i. Denudational hills of Granites ii. Extension of Malwa plateau iii. Pediments over Traps, Lameta and Granites	
	2. Major Drainage:	i. Mahi River & Anas River ii. Narmada River & its tributaries Hatni, Orsang & Bagh Rivers	
Anas	Land Use		('000 ha)
	a) Forest area	131.7	
	d) Net area sown	359.46	
	f) Gross cropped area	414.139	
4.	Major Soil Types		Alluvium, black cotton soil and sandy soil
5.	Principal Crops		a) Soyabean b) Gram c) Maize d) Wheat e) Jowar f) Rice g) Urad h) Cotton i) Groundnut
6.	Irrigation By Different Sources		No. Area irrigated ('000ha')

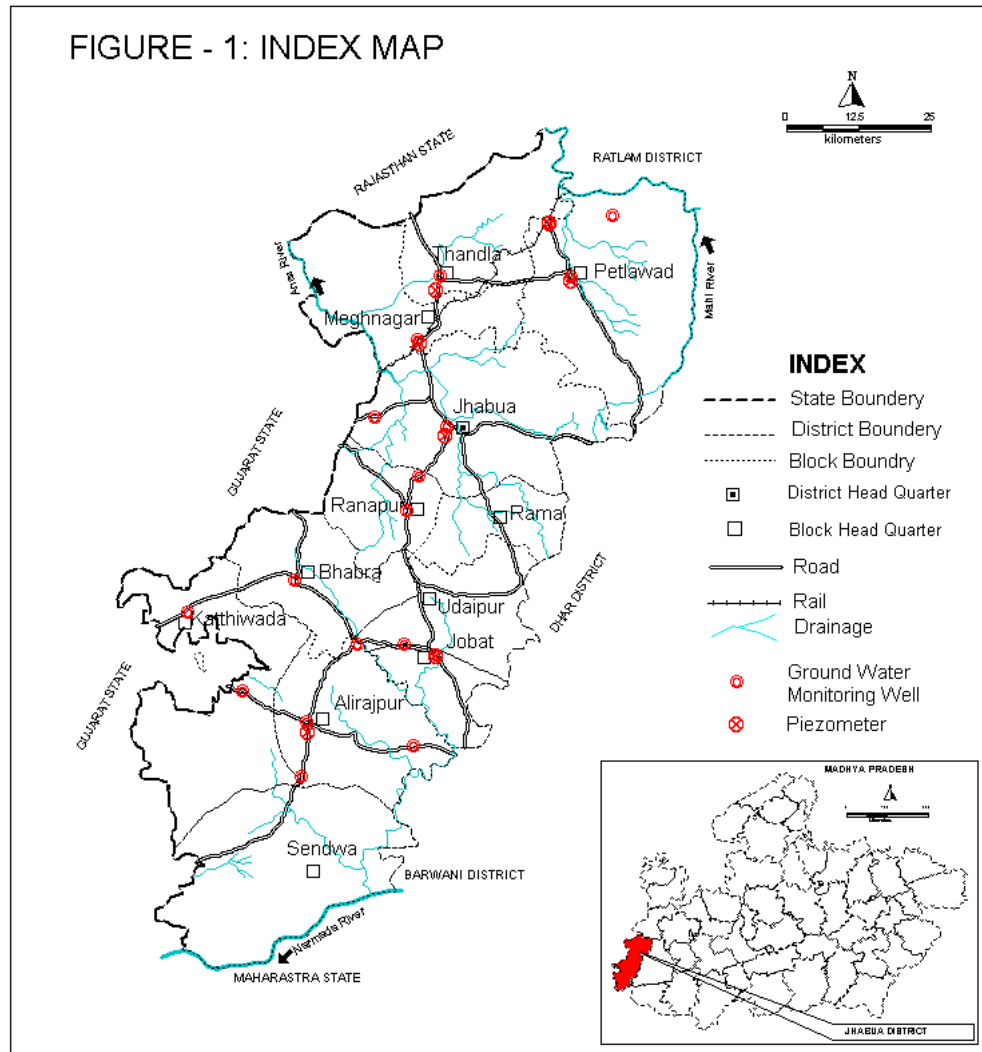
	Dug wells	22882	22.132
	Tube wells/Bore wells	1924	1.721
	Tanks/Ponds	614	10.682
	Canals	339	9.773
	Other Sources	-	23.449
	Net Irrigated Area	-	63.639
	Gross Irrigated Area	-	67.757
7.	Number Of Ground Water Monitoring Wells of CGWB (As on 31.3.2013)		
	Number of Dug Wells	10	
	Number of Piezometers	5	
8	Predominant Geological Formations	Recent alluvium, Deccan Trap basalts, Bagh Beds and Archaeans Granites.	
9	Hydrogeology		
	Major Water Bearing Formation	Sandy alluvium, Weathered/vesicular basalt, Sand and Limestone of Lameta beds and Weathered and fractured Granites.	
	Pre-monsoon depth to water level during 2012	3.45-14.95 m bgl	
	Post-monsoon depth to water level during 2012	2.00 – 11.10 m bgl	
	Long-term water level trend in 10 years (2003-2012)	0.03-0.1(rise) 0 .02-0.1(fall)	
10.	Ground Water Exploration By CGWB (As on 31.3.2013)		
	No of wells drilled (EW, OW, PZ, Total)	26 (EW-19, Pz -7)	
	Depth Range	68.75 – 213.27 m. bgl	
	Discharge	Meager – 400 lpm	
	Specific Capacity	-	
	Transmissivity	-	
11.	Ground Water Quality		
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	EC (310-1175) $\mu\text{s/cm}$ at 25 ⁰ C Nitrate-2.5-87 F (0.18 – 1.3) mg/l	
12	Dynamic Ground Water Resources (2009)		
	Net Annual Ground Water Availability	201.34	
	Gross Ground Water Draft	93.05	
	Projected Demand for Domestic and Industrial uses up to 2033	30.67	
	Stage of Ground Water Development	46%	
13	Awareness and Training Activity		
	Mass Awareness Programme Organised	1, Fluorosis and Fluoride in Ground Water	

	Water Management Training Programme	Nil
14	Efforts of Artificial Recharge & Rainwater Harvesting	
	Projects completed by CGWB	Nil
	Projects under technical guidance of CGWB	Technology Mission on drinking water
15	Ground Water Control and Regulation	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Notified Blocks	Nil
16	Major Ground Water Problems and Issues	Fluoride contamination in Ground Water

INTRODUCTION

Jhabua is a predominantly tribal district located in the western part of Madhya Pradesh. Panchmahal and Baroda districts of Gujrat State, Banswara district of Rajasthan State and Dhar and Ratlam districts of Madhya Pradesh surround it (fig 1). River Narmada forms the southern boundary of the district. Jhabua district extends between the parallels of North latitudes $21^{\circ} 55' 23''$ and $23^{\circ} 17' 18''$ and between the East longitudes $74^{\circ} 01' 52''$ and $75^{\circ} 00' 52''$. Most part of Jhabua is without any forest cover because of low fertility of land and soil erosion even mere existence becomes a hard problem and with the failure of rains. Jhabua is sparsely populated area with the total population of 1,024,091 according to 2011 census.

The district is devoid of vegetation cover except Katthiwada and other patches and is full of undulated, hilly areas. The area suffers from poor and skeletal soils with shallow to very shallow depth and erratic rainfall, high temperature. The area comes under Agro climatic zone No. 12 namely Jhabua hills. The district has three distinct sub zones namely Petlawad (Malwa), Jhabua (Low rainfall) and Katthiwada (High rainfall) zones.



Central Ground Water Board Activities:

- Shri A..B. Deshmukh, Jr. Hydrogeologist, conducted Systematic hydrogeological surveys in the district during 1984-85.
- Shri P. K. Sahajpal, Jr. Hydrogeologist, Shri M. L. Parmar, Asst. Hydrogeologist and Shri P. Srinivasan Asst. Hydrogeologist conducted Systematic hydrogeological surveys in district the during 1986-87.
- Under “Technology Mission on Drinking water” CGWB has provided technical guidance to the State Government for locating suitable drilling sites during 1987-90.
- Central Ground Water Board conducted ground water exploration in the district and constructed 7 exploratory wells and 26 deposit wells during 1988-89.

1.0 RAINFALL AND CLIMATE

Climate is generally moderate and seasons are well defined. The summers are hot, winters are short and the monsoon season is generally pleasant. The average annual rainfall in the district is 855.5mm. Most of the rainfall occurs in monsoon season while there is also a little of rainfall in winter season

A hot summer and general dryness characterize the climate of Jhabua district, except during the southwest monsoon season. The year can be divided in to four seasons. The winter commences from middle of November and lasts till the end of February. The period from March to about middle of June is the hot summer season. May is the hottest month of the year. The southwest monsoon starts from middle of June and lasts till end of September. October and middle of November constitute the post monsoon or retreating monsoon season.

The temperature starts rising from the beginning of February and reaching maximum in the month of May. The normal annual mean maximum temperature is 32.8⁰C and normal annual mean minimum temperature is 19.1⁰C. The individual day maximum temperature in May goes up to 39.5⁰C. The individual day minimum temperature is recorded 11⁰C in the month of January. The march is the driest month of the year. The humidity comes down lowest in April. It varies between 41 % and 89 % at different during April and August. The wind velocity is high during the pre monsoon period as compared to post monsoon period. The wind velocity is highest in June around 15.9 km/hr and lowest is 3.2 km/hr in November. The average normal annual wind velocity of Jhabua district is 7.8 km/hr.

The normal annual rainfall of Jhabua district is 855.5 mm. Jhabua district receive maximum rainfall during southwest monsoon period i.e. June to November. About 92.8% of annual rainfall is received during monsoon season. Only 7.2% of annual rainfall takes place between Octobers to May period. The surplus water for ground water recharge is available only during the southwest monsoon period.

2.0 GEOMORPHOLOGY & SOIL TYPES

Jhabua district is mainly a hilly region covered with a chain of hills known as “The Vindhyachal” which extends northwards towards Udaipur in Rajasthan. The maximum density of the hills is in the southern part of the district in Alirajpur tehsil. The maximum elevation of 777 m. amsl is recorded near Mathwar village in Sondwa block. The general trends of the hills are in east-west direction.

Jhabua district lies in the major basins, the Mahi in the north and the Narmada in the south. The Narmada River forms the southern boundary of the district with a westerly flow of water. The major tributaries having their confluence with the Narmada are Hatni, Ankhar, Sukar, Orsang, Heran, Kara and Bagh. Narmada river has a length of 50 Km. In the district and along with its tributaries drains 48% of the geographical area.

The Mahi River forms northern and northeastern boundary of the district. It has a length of 67 Km. Within the district limits and along with its left bank tributaries. The Anas and Pampawati drains 52% of the geographical area of the district. The Anas river with its tributaries Like Mod, Sapan and Sunar, Negaria and Pat covers 38% of the geographical area of the district.

The variation in climatic condition, topography and lithology in Jhabua district has played a significant role in the formation of soil which has resulted from the physical and chemical weathering of the parent rock. Black cotton soil has been derived from the parent basaltic rock under semi-arid conditions. These soils are clay to loamy clay in texture, having clay contents of 40% to 60% mixed with red and yellow soil. The soil generally occurs in

slopes and uplands are sandy-to-sandy loam and their colour varies from reddish yellow yellowish brown.

3.0 GROUNDWATER SCENARIO

3.1 Geology

The general geological successions in the district are given in table-1.

Table-1: General geological successions of Jhabua district.

Age	Stratigraphic Unit	Lithology
Quaternary to Recent	Recent Alluvium	Alluvium and Laterite
----- Unconformity -----		
Upper Cretaceous to Lower Eocene	Deccan trap	Basalt with inter trappean clays
Upper Cretaceous	Lameta and Bagh Beds	Limestone and shale
Archaean	Aravali Super Group	Granites, Phyllites, Schist and Dolomitic Marble

3.2 Hydrogeology

The general hydrogeological conditions of the district are depicted in figure-2 and formation wise settings are discussed below.

3.2.1 *Archaeans*

The Archaean group of rocks are exposed in the central, northwestern parts of the district. The groundwater generally occurs under phreatic conditions in the weathered, jointed and fractured horizons of different rock units. The pink and grey granites are exposed mainly in Alirajpur tahsil are generally hard and compact and are poorly permeable rocks. The gneissic granites are susceptible to weathering with jointed and fractured zones extending about 5 to 15 m below ground level. The occurrence of groundwater in the granites and gneissic granites depend on the depth of weathering. The phyllites and schist are moderately permeable. The occurrence of groundwater is dependant on the intensity of fractures and disposition of foliation planes. The dolomitic marble and limestone occurring as bands, generally occurring occupy small hill ranges and as such their geographic locations is unfavorable for ground water development. Krastic limestone supports good yields from phreatic aquifer.

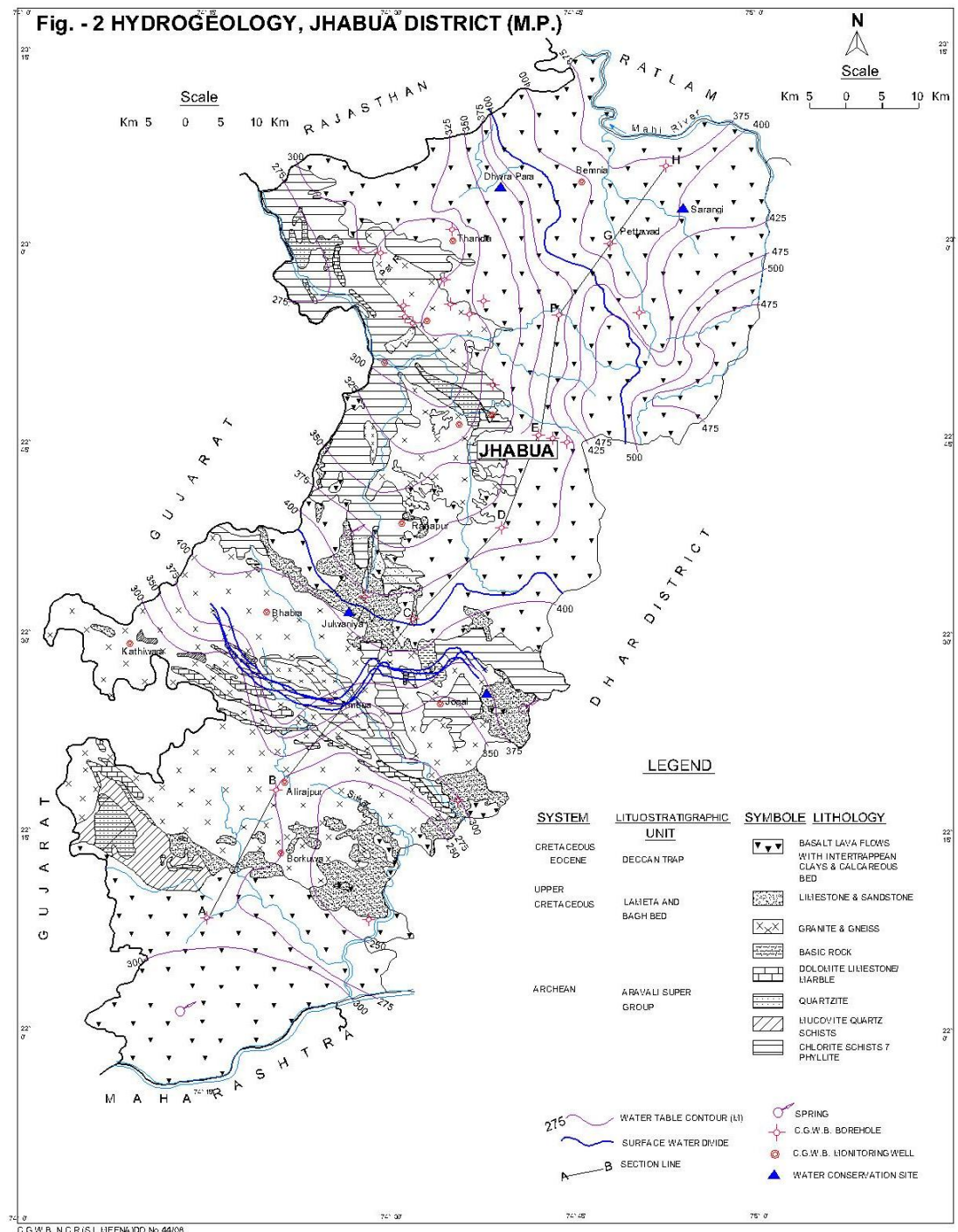
3.2.2 *Lameta and Bagh Beds*

Overlying unconformably the Archaeans, are the infra-trappean represented by the Lameta and the Bagh beds. The main exposures are seen in the southeastern and central parts of the district. The outcrops occur in widely separated patches and the lithostratigraphy differs from place to place. In general the rock unit lower arenaceous and upper calcareous

facies. Nimar sandstone, the basal units of the Bagh beds in the area are horizontally bedded and compact in nature with an average thickness of 12 to 18 meters. Though hard and compact, they are well jointed and fractured and act as groundwater repository. Nimar sandstone is overlain by nodular limestone and coralline limestone. The groundwater occurs generally under phreatic conditions in the Infra-trappean sandstone and limestone. Limestone Solution activities these rocks act as promising horizons for groundwater storage. Dug wells tapping the Bagh beds in the lower elevation generally give good discharge. The Infra-trappean beds underlying the Deccan traps when encountered during drilling exhibit confined /semi confined conditions.

3.2.3 Deccan Traps

The northern and north western parts of the district covering mainly Thandla, Petlawad and Rama blocks and southern parts covered by Sondwa block are occupied by the basaltic lava flows of Cretaceous to Eocene age. More than 12 number lava flows have been demarcated in the district with average thickness of flow being 25-30 m. The bottom most parts of the flows are generally massive, hard and compact in nature. They often show columnar jointing and



spheroidal weathering. The overlying vesicular basalts comprise has rounded to oval shaped vesicle, which is generally filled, with zeolites, calcite and quartz. Vesicular horizons are limited in thickness or absent there by reducing the chances of the good aquifer for the storage for groundwater storage. The weathered zones, joints, fracture and vesicular zones form the main water bearing horizons. The open dug well located in the geographic low often yields 50-100 m³/day. The bore well tapping different vesicular horizons yield moderate quantity of water(100-200 m³/day).

3.2.4 Alluvium and Laterite

Localized patches of alluvium cover occur along the banks of major and minor rivers and streams in the district. In general it is difficult to differentiate between alluvium and product of black cotton soil underlain by yellow clay with kankar. The thickness of alluvium varies from few meters to 15 m. Laterite capping on top of Deccan trap basalt are seen in localized patches. The rocks are generally bouldery in nature, highly ferruginous and weathered to yellowish red soil.

3.3 Aquifer Parameters

The exploratory drilling has been carried out in areas occupied by Deccan Trap basalt underlain by Lameta limestone and granite and gneissic rocks. In Deccan Traps, the vesicular, weathered and fractured basalt form the aquifers while in Granites and gneissic rocks Weathering and fractures forms aquifer. These exploratory wells have been drilled down to the maximum depth of 213.27 m bgl and their yields have been recorded. The details of exploration carried by CGWB have been tabulated in table - 2.

Table – 2: Hydrogeological details of exploration carried by CGWB in Jhabua district.

S.NO.	Location Coordinates Topo sheet No.	Depth Drilled (m.b.g.l.)	Geological Formations	Aquifer Zones (m. b.g.l.)	S.W.L. (m.b.g.l.)	Discharge Q (Lps)	Drawdown (m)	Trans-missivity T (m ² /day)	Storage Coefficient.	EC (Micro Siemens/cm.at 25°C.)	Year Constructed
1	Ambaja 22° 07' 74° 15' 46 J/8	156.96 -	Basalt Granite Gneiss at 61.95	3-12 82-88.55 103.75-111.35	4.74	206 12.63		12.09	1.1		1987-88
2	Alirajpur 22° 18' 74° 21' 46 J/7	81.04 -	Granitic gneiss	5-13				-			
3	Indwan 22° 17' 74° 37' 46 J/11	88.75	0-61.95 Bagh Sandstone 61.95-88.69 Granitic gneiss	8.75 - 28.00 31.2-43.00	9.54	3.00	-	-	-	493	1987-88
4	Tikhola	88.69	0-65.9 Bagh limestone and	65.9-88.69	8.63	120		12.16	5.6x10		1988-89

	22°08' 74°28' 46 J/8	147.32	shale 88.69-112.12 Bagh shale quartzite at 112.12	27-32.06 87-103		27.56					
5	Udaigarh 22°32' 74°32' 46 J/10	65.74 134.2	0.9-11.0 Bagh sandstone 11.0-16.15 Chlorite schist 16.15-74.00 Granitic gneiss	5.0-11.0	2.2	20	-	851		1987-88	
6	Talawali 22° 49' 74° 38' 46 J/09	EW- 134.20 OW- 68.75	0-24.0 Bagh sandstone 24.0-31.60 Chlorite schist 31.60-63.09 Granitic gneiss	3.76-30.00 8.50-14.50 31.35-38.00	3.47 2.93	10.0 4.50	- - -	1075 627	- -	1987-88	
7	Bhakatgarh 22°03' 74°09' 46 J/4	177.72 177.72	Basalt	26.9-30.9 34.5-38.5 61.3-64.9 122.1-125.7 160.0-163.7 171.3-175.3	22.22	227 1.89		55.48	7.7x10	1989-90	
8	Bori 22 31 74 42 46 J/10	99.37	Limestone sandstone shale	2.0-8.2	1.3	101				1989-90	
9	Chhaktala 22 05 74 15 J/8	92.26 92.26	Basalt	23.27-92.26	6	1655 10				1990-91	
10	Chinota 22 30 74 30 46 J/8	129.6 73.5	Basalt	49.5 - 54.5 57.5 - 70.5	11.05 344.4 27	1.7 x 10 T=10. 17				1990-91	

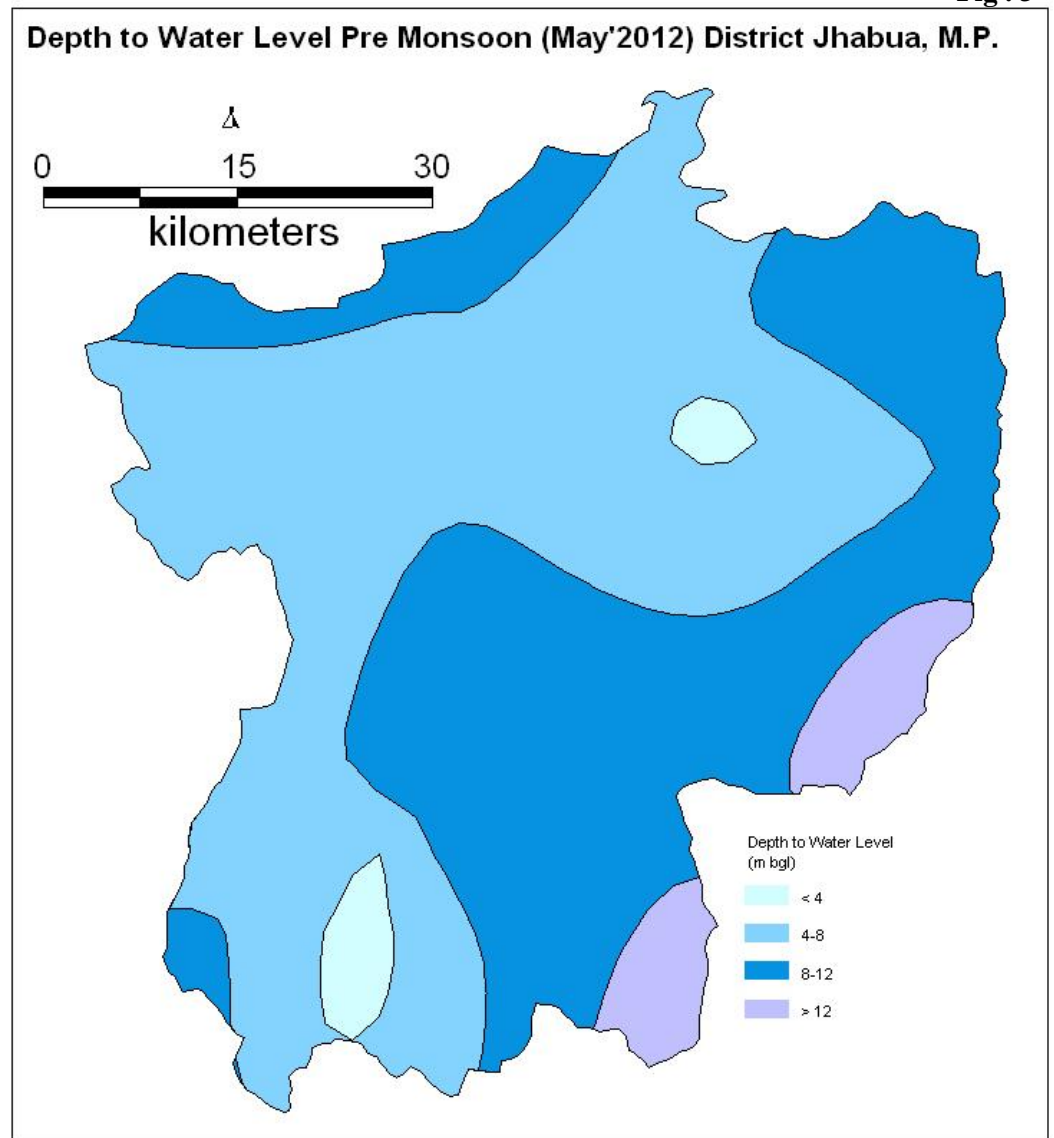
11	Kharwad 22°32' 74°32' 46 J/10	124.18	0-54.29 - 114.98 phyllites Granitic gneiss at 114.98	13.6 - 16.8 50.6 - 56.6 104.0 - 107.4 112.4 - 115.00	5.74	50					1987 - 88
12	Kulwat 22°31' 74°29' 46 J/6	144.77	Deccan trap	40.0 - 46.04 60.95 - 63.95 95.0 - 110.26 125.82 - 132.26	2.46	1165					1988-89
13	Padal 22°07' 74°15' 46 J/8	157.09		4.5 - 8.7 54.3 - 63.0	4.34	90					1987-88
14	Phartala 22°18' 74°21' 46 J/7	110.56	baghbeds (Lst, Sst, Shale)	72-88	0.42	378					1988-89
15	Phulmal 22°11' 74°10' 46 J/4	188.8	basalt sandstone limestone phyllite	48 - 52 167 - 175 185 - 188	2.6	800 26.22					1989-90
16	Sondwa 22°07' 74°22' 46 J/8	176.92 176.2	Basalt	5.2 - 15.72 26.92 - 38.52 40.5 - 43.0 46.12 - 49.72	18.63 18.63	330 5.48	2.4x10				1989-90
17	Umralli 22 11 74 19 46 J/10	213.27	Basalt limestone sandstone Basic sill dolerite	5.0 - 8.0 95.0 - 99.0 102.0 - 105.00 110.0 - 118.0 140.0 - 143.0 170.0 - 175.0	0.21	127 31.79					1989-90
18	Walpur 22 08 74 28 46 J/8	158.82 128.4	Basalt Limestone sandstone shale	52.0 - 56.0 94.0 - 98.0 98.6 - 101.6 120.8 - 128 .4	7.54	314 10.48	52.33	1.1x10			1989-90

3.4 Ground Water Levels

Variation of groundwater levels in an area is an important component of hydrological cycle because it is a physical reflection of aquifer systems. To monitor the seasonal and annual change in quantity and quality of groundwater, CGWB has established 10 Ground Water Monitoring Wells and 5 Piezometers in Jhabua district. The monitoring of groundwater levels in these wells is being carried out by CGWB during the month of May, August, November and January. The brief details of groundwater level in Jhabua district for the year 2012 are being discussed below:

3.4.1 Pre-monsoon (May 2012)

The premonsoon depth to water level (DTW) map of the district is presented as figure 3. The DTW ranges between 3.45 and 14.95 mbgl. In general deeper water levels are observed in eastern part whereas, shallower water levels are observed in western part. In major part DTW ranges between 4 and 12 mbgl. Deeper water levels on more than 12 mbgl are observed in eastern part.

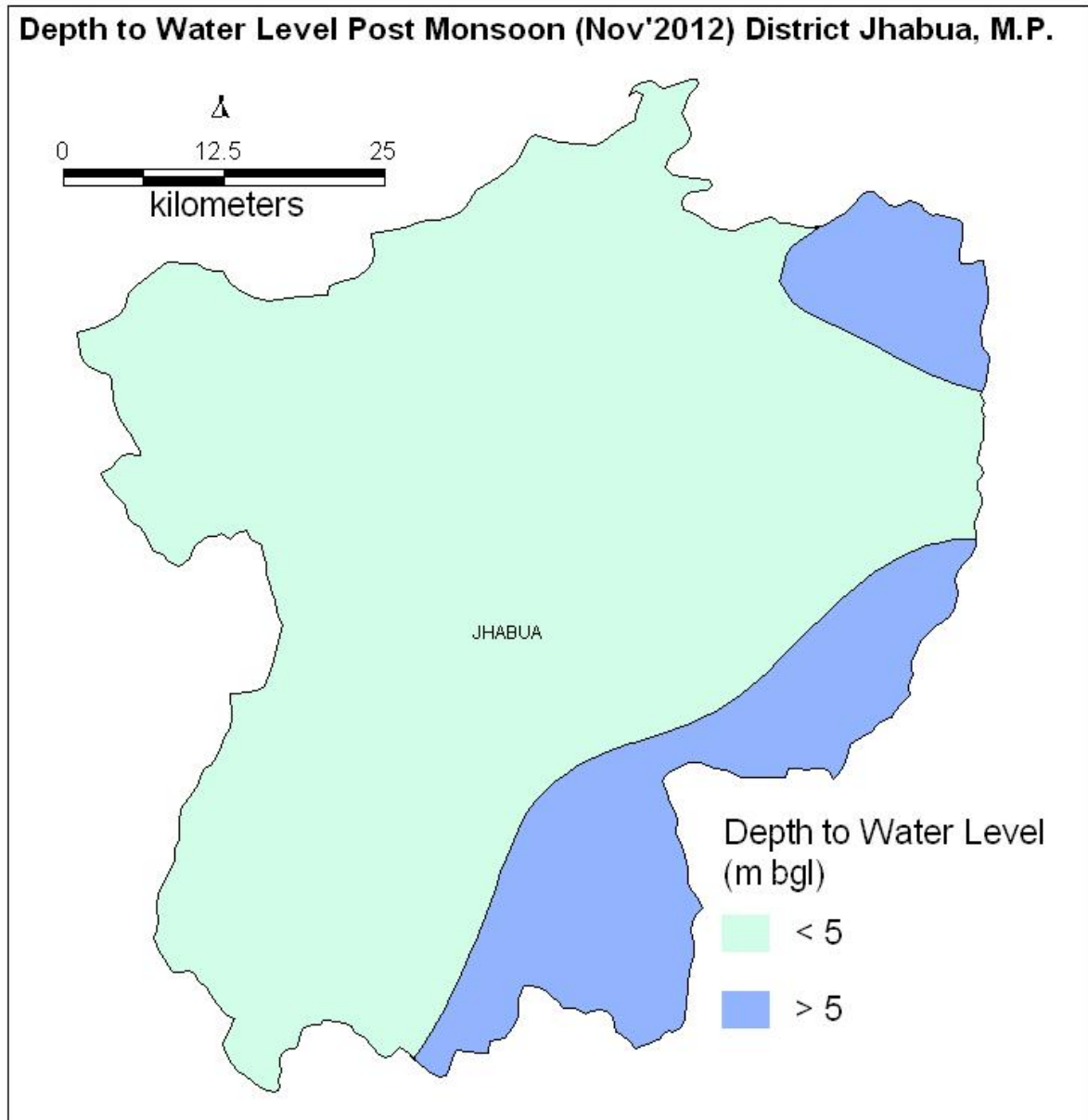


3.4.2 Post-monsoon (November 2012)

The postmonsoon depth to water level (DTW) map of the district is presented as figure 4. The DTW ranges between 2.00 to 11.10 mbgl. In general deeper water levels are observed in eastern part whereas, shallower water levels are observed in western part. In

major part DTW is less than 5 mbgl. Deeper water levels on more than 5 mbgl are observed in eastern and south eastern part.

Fig . 4



3.4.5 Ground Water level trend (2003-2012)

Analyses of ground water level data of post-monsoon period indicate that both declining and rising trends in water level are observed in the district. In general 0.03 to 0.01 m/year water level rise has been observed in the district and 0.02 to 0.1 m/year water level declines has been observed in the district.

3.5 Ground Water Resources:

The Assessment of Ground Water Resources of Jhabua district are carried out block wise during 2009 and is given as table 3. The Net annual ground water availability in the Jhabua district is 201.34 MCM and ground water draft from all uses is 93.05 MCM. Net

ground water available for future irrigation use is 100.51 MCM. The stage of ground water development of Jhabua district is only 46 %.

The block of Rama and Petlawad has command area as well non-command areas, while others block of Jhabua districts have only non-command area. All the blocks of Jhabua district are Categorized as **Safe**.

Table-3. Ground water availability and stage of development in Jhabua district

District/ Assessment Unit	Sub-unit Command/ Non- Command/	Net Annual Ground water Availability (ham)	Existing Gross Ground water Draft for Irrigation (ham)	Existing Gross Ground water Draft for Domestic & Industrial water Supply (ham)	Existing Gross Ground water Draft for All uses (ham)	Provision for domestic, and industrial requirement supply to next 25 year (2033) (ham)	Net Ground water Availability for future irrigation d development (ham)	Stage of Ground water developm ent (%)	
Jhabua									
Jhabua	Command								
	Non- Command	1905	462	664	1126	841	602	59	Safe
	Block Total	1905	462	664	1126	841	602	59	Safe
Meghnagar	Command								
	Non- Command	2927	853	320	1173	463	1611	40	Safe
	Block Total	2927	853	320	1173	463	1611	40	Safe
Petlawad	Command								
	Non- Command	7902	2964	425	3390	659	4279	43	Safe
	Block Total	7902	2964	425	3390	659	4279	43	Safe
Ranapur	Command								
	Non- Command	1836	607	204	810	220	1009	44	Safe
	Block Total	1836	607	204	810	220	1009	44	Safe
Rama	Command								
	Non- Command	2703	810	362	1172	545	1349	43	Safe
	Block Total	2703	810	362	1172	545	1349	43	Safe
Thandla	Command								
	Non- Command	2860	1320	314	1634	340	1200	57	Safe
	Block Total	2860	1320	314	1634	340	1200	57	Safe
	District Total	20134	7016	2289	9305	3067	10051	46	

3.6 Ground Water Quality

Ground water quality of Jhabua district is being assessed annually by CGWB on the basis of analysis of ground water samples collected from 10 number of hydrograph stations in the district. On the basis of examination of data for the year 2011, the water quality is described as follows.

The electrical conductivity (EC) is a measure of salinity. The EC ranges from 310 to 1175 $\mu\text{s}/\text{cm}$ at 25⁰C. The fluoride concentration in the district ranges between 0.18 – 1.3 mg/l. The nitrate concentration in Jhabua district ranges from 2.5mg/l to 87mg/l.