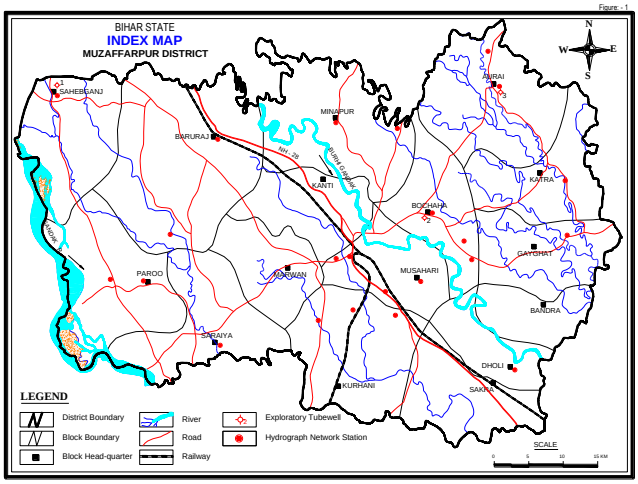
भूजल सूचना पुस्तिका

मुजफ्फरपुर जिला, बिहार

Ground Water Information Booklet

Muzaffarpur District, Bihar State



केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region
Patna

सितंबर 2013

September 2013

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MUZAFFARPUR DISTRICT AT A GLANCE

Sl. No.	ITEMS	Statistics	
1.	GENERAL INFORMATION		
	i) Geographical area (Sq Km)		3172
	Administrative Division		
	i) Number of Tehsil/ Block		16
	ii) Number of Punchyat/Villages		1811
	iii) Population (As on 2011 Census)		Urban:469896 Rural:4308714
	iv) Average Annual Rainfall (mm)		1284
2.	GEOMORPHOLOGY		
	Major physiographic unit:		
	Major Drainages:	Gandak, Burhi Gandak	
3.	LAND USE (Sq Km)		
	a) Forest area:		Nil
	b) Net area sown:		2290.6
	c) Cultivable area:		
4.	MAJOR SOIL TYPE		
5.	AREA UNDER PRINCIPAL CROPS		
6.	IRRIGATION BY DIFFERENT SOURCES (Areas Sqkm and Number of Structures)	Area	No.
	Dugwell	-	108
	Tubewell/Borewell	1121.68	34874
	Tank/ponds	2	-
	Canals	20	-
	Other sources	-	87
	Net irrigated area	1121.68	
	Gross irrigated area	1326.54	
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2011)		
	No of Dug wells	16	
	No of Piezometers	Nil	
8.	PREDOMINENT GEOLOGICAL FORMATIONS	Quaternary Alluvium	
9.	HYDROGEOLOGY		
	Major Water bearing formation		
	(Pre-monsoon Depth to water level during 2011) m bgl.	2.09 to 7.63	
	(Post-monsoon Depth to water level during 2011) m bgl.	0.67 to 5.21	
	Long term water level trend in 10 yrs (2002-2011) in m/yr		-

10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)		
	No of wells drilled (EW, OW, PZ, SH, Total)		3 + 3
	Depth range (m)		55.5 to 121.85
	Discharge (litres per second)		**14 to 26**
	Storativity (S)		**2.6 X 10^{-3}**
	Transmissivity (m^2/day)		**1274 to 1576**
11.	GROUND WATER QUALITY		
	Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe)		
	Type of water	Potable	
12.	DYNAMIC GROUND WATER RESOURCES(as on 31st March 2009)- in mcm		
	Annual Replenishable Ground water Resources		1070.52
	Net Annual Ground Water Draft		501.52
	Projected Demand for Domestic and industrial Uses up to 2025		108.39
	Stage of Ground Water Development		53.50%
13.	AWARENESS AND TRAINING ACTIVITY		
	Mass Awareness Programmes organized		Nil
	Date:		
	Place:		
	No of participant:		
	Water Management Training Programmes organized	Nil	
	Date	-	
	Place	-	
	No of participant	-	
14.	EFFORT OF RTIFICIAL RECHARGE & RAIN WATER HARVESTING		
	Project completed by CGWB (No & Amount spent)	Nil	
	Project under technical guidance of CGWB (Numbers)	Nil	
15.	GROUND WATER CONTROL AND REGULATION		
	Number of OE Blocks	Nil	
	Number of Critical Blocks	Nil	
	Number of Blocks notified	Nil	
16	MAJOR GROUND WATER PROBLEMS AND ISSUES		

Ground Water Information Booklet
Muzaffarpur District, Bihar state

1.0 INTRODUCTION

1.1 Administration

Muzaffarpur district lies in North Bihar (i.e. North of Ganga). It covers a geographical area of 3132 Km^2 and falls under 72 F, 72 G and 72 B degree sheets of Survey of India. It lies between North Latitude $25^0$54'00"to $26^0$23'00" and East Longitude $84^0$53'00" to $85^0$45'00" It is sounded by Sitamarhi and East Champaran in North and Vaishali and Saran in south whereas in east. It is sounded by Darbhanga and Samastipur and in west by Saran and Gopalganj district. The district with its headquarter at Muzaffarpur is having 16 administrative development blocks. The district headquarters as well as all the blocks are well connected with state capital by road. The total population of the district as per 2011 census is 47.78 Lakhs with Rural 4308714 & Urban 469896.

1.2 Basin/Sub-basin, Drainage

The drainage system of the area originates from Himalayas and converges into the major rivers of the district. The district is mainly drained by river Burhi Gandak, Baghmati, Baya which generally flow in south easterly direction. Though all three rivers and their tributaries are perennial but these rivers are very in predictable during rainy season during monsoon, these rivers become very devastating in nature causing flood in this area. Due to this peculiar character, the sedimentation rate during monsoon is very high near the river banks which have resulted in formation of the elevated up land and gradually decreases away from the river channels.

1.3 Irrigation Practices

The Baghmati, Burhi Gandak rivers and their tributaries are the perennial source for irrigation in the district.

After construction of Gandak Canal the total scenario for irrigation is the district has been changed.

The canal system covers the Saraiya, Kurhani, Paru, Muraul and Sakra blocks fully whereas it covers partially Sahebganj, Mushari, Deoria, Kanti and Minapur blocks. The total length of the Gandak canal in the district is 71.95 Km starting from 537 RL.

Apart from this natural resource (rivers) and canal system, there are number of private as well as Govt. tubewells also, helping in the irrigation potential in the district. The data from different sources show that the cropping intensity increased by many folds due to available different kinds of irrigation facilities.

1.4 Studies/activities carried out by CGWB

The Central Ground Water Board has carried out hydrogeological surveys followed by ground water exploration in alluvial of the district. A report entitled “Hydrogeology and Ground Water Resource Development Plan of Muzaffarpur district, Bihar” was issued in the year 1996. The ground water exploration programme is continuing till date. A total of 3 exploratory wells have been drilled in marginal alluvium area. Water levels of 25 hydrograph stations representing phreatic aquirfer are being monitored four times a year since 1975. Chemical quality of ground water of phreatic aquifer is monitored for premonsoon period. Ground water resource has been estimated for the district (GEC-1997, norm) as on 31st March 2009.

2.0 Rainfall and Climate

The district received an average rainfall of 1280 mm. Period from June to September is well known for monsoon. The monthly rainfall data shows that 85% of rainfall comes during monsoon period. The district gains its maximum rainfall from south-westerly monsoon during rainy season and a little percentage from North Easterly monsoon during winter.

The district experiences a severe winter followed by a very hot summer and then by heavy downpour of monsoon. The summer starts here from April and lasts upto June, and then monsoon starts and continues upto September. After this winter starts from November that contnues upto middle of March. Temperature starts increasing from late March and gains its peak during May. The temperature ranges between 27^0C to 38^0C in general but sometimes it goes even upto 44^0C also.

3.0 Geomorphology and Soil types

3.1 Geomorphology

In the district the main aquifer materials consist of fine to medium sand or fine sand mixed with silts with occasional kankar and gravels. In shallow aquifer zones the ground water is generally under water table condition whereas deeper aquifers are under semi confined to confined condition.

3.2 Soil

The entire district is occupied by alluvium. In this district there are in general four types of soils. They are grouped as sandy loam, clayey, a clay soil containing an admixture of sand called as Bangar and lastly the patches of Usar land containing the salt effloregences that is called as reh in local languages while the sandy loam variety predominate in south of Burhi Gandak river. The bangar and clayey soils are found in the north. The Usar land is distributed in patches in the western part. As water logging is also present in some part of the district, the salinisation and alkalisation increases in the soil of the district.

4.0 Ground Water

4.1 Hydrogeology

Precipitation is the main source of ground water recharge in Muzaffarpur district. Out of the total rainfall in the district, a part of it directly evaporates from the land surface, a part is absorbed by vegetation and other part reaches the rivers, lakes and ponds etc. as surface run off and remaining part percolates down to the ground water body through sandy soils.

The surface and sub-surface geological condition controls the occurrence and movement and ground water in the area. In order to explain the ground water regime clearly, a hydrogeological map was prepared. The ground water generally occurs under confined to semi confined conditions is deeper aquifers. Sands of varying grades form the prominent aquifers in the area.

A ground water table map was prepared taking the depth to water level data of pre monsoon period of 1999 of Key wells established in the area. The map shows that the lowest water table contour value is 42 mm above MSL in the south-eastern part.

The hydraulic gradient of the district varies from place to place but in general it is very gentle. There is no marked difference in hydraulic gradient. The value shows that an average value of gradient is 0.289 m/Km. The low value of hydraulic gradient shows that the saturated granular sediments are of higher permeability.

The study of deeper aquifer in the district based upon data and bore wells drilled in the district by CGWB, Private parties and state Govt. show that a thick un-consolidated sediments consisting of clay, various grades of sand, silts and gravels, form a prominent aquifer. The main granular zones are found within a depth range between 60-100 m.

The study of sub-surface geology reveals that there is a considerable variation in thickness and granularlity of the aquifer materials of the area.

A perusal of the geological cross-section shows that a thick aquifer consisting mainly of fine and medium sand occurs below thick clay, which includes more than one thin sandy intercalation. The upper fraction in mainly medium grained towards the west and fine grained towards the east.

4.2 Ground Water Resources

The main source of the ground water recharge in the district is rainfall. Apart from this, the return flow from ground water irrigation, seepage from canal, ponds, tanks and direct infiltration from river beds during stream flow are the other secondary sources of recharge. The annual recharge of ground water bodies constitute the replenishable or dynamic resource.

The blockwise ground water resource of Muzaffarpur district has been calculated upto 31.03.2009 as per the norms laid down by the Ground Water Estimation Committee, Ministry of Water Resources, Govt. of India, 1997. The detail is being given in annexure.

	In MCM
Total Ground Water Resource	1070.52
Total ground Water Resource for irrigation	501.52
Gross annual Ground water Draft	572.77
Ground water Balance	497.75
Level of ground water development	53.5 %
Allocation for Domestic and Industrial Requirement Supply upto year 2025	108.39

As per estimation of block wise draft data the level of development is maximum (89 %) in Mushari block whereas in the block of Kanti the development is the minimum (39.2 %).

4.3 Chemical Quality of Ground Water

For the hydrogeological study of any area. It is very much essential to know the qualitative aspects of the ground water of the area. To know the chemical quality of the area water samples are being collected from dug wells and shallow tubewells and they are chemically analysed in chemical laboratory of CGWB, MER, Patna and the detailed study of chemical data; of ground water indicates; that water of the shallow aquifers of the area is more or less good and potable for drinking, industrial as well as agriculture uses.

The data reveals that the ground water of the area is general alkaline in nature as pH value ranges between 7.60 to 8.65

4.4 Status of Ground Water Development-Block wise

The occurrence and movement of ground water is governed by geology and geomorphology. An attempt has been made to summarize block wise information on suitable well type, depths, discharge and suitable drilling method.

5.0 Ground Water Management Strategy

5.1 Ground Water Development

The assessment of ground water resource of Mluzaffarpur district shows that still there is a vide scope for utilising the balance ground water resource. The data clearly indicates that though some blocks are having more development percentage but still more than 50% of the area is at about 55% of development stage. Except blocks like Sakra, Muraul, Sahabganj, Bochha and Sakra, be using different means of feasible ground water structures there is still a vast scope to harness the available ground water resource to a sizeable extent.

Though some blocks are covered by Gandak canal system, but due to unlined canals, it is also not giving much help in irrigation facility in the district.

So many medium to heavy tubewells were constructed by state Govt to facilitate the irrigation system but due to some mechanical as well as technical problems and to some extent due to financial constraints the irrigation facility is still not fully utilized.. It has also been observed that at present maximum percentage of irrigated area is being covered by shallow (Private) and shallow cavity tube wells. The irrigation in the district is done to some extent by dug wells also, but during extreme summer or in the period of scanty rainfall it is also not serving well.

Future Ground Water Development

As per present scenario for ground water utilisation it is evident that still a vast ground water reserve is available for future development. As the entire area is having very good granular zones, so, by using the high yielding and low yielding tube wells the demand for domestic supply as well as irrigation requirement can be met as per the demand of user agencies. The yield of the dug wells can be also enhanced by cavity borings, so that, the dug wells also can serve even in draught situation to some limited capacity.

Keeping in account that one shallow well can harness a discharge of 10 to 20 m^3/hr, medium well can yield a discharge of 50 m^3/hr whereas deep tubewells even yield upto 100,150 and 250 m^3/hr discharge and if a total 1300 hrs is taken as running hours per annum, would produce an annual draft like 0.0195 MCM, 0.065 MCM, 0.13 MCM and 0.26 MCM respectively.

Based upon the litholog and hydrogeological parameters suggestion for the design and spacing between two wells is given as below :-

Type	**Distance**	**Depth**	**Slott size**	**Discharge**
Shallow private wells	150-200 m	50 mt	1/16”	20 m^3/hr
Medium tube wells	500 mt	100 mt	1/16”	50-100 m^3/hr
Deep tube wells	1000 mt	200 mt	1/16”	150-200 m^3/hr

5.2 Water Conservation and Artificial Recharge

All the blocks of the district fall under safe category. Artificial recharge and Rainwater Harvesting Technique may be adopted in the Minapur and Sakra blocks where the stage of ground water development is high. As the entire district

is covered by alluvial formation, contour bunding and recharge ponds are most suitable structure in the rural areas of the blocks.

6.0 Ground Water related Issue and Problems

There is no ground water related issues and problems in the district.

7.0 Mass Awareness and Training Activity

7.1 Mass Awareness Programme

Till date, no Mass Awareness and Training programme are conducted in the district.

8.0 Area notified by Central Ground Water Authority (CGWA)/ State Ground Water Authority (SGWA)

The blocks of Muzaffarpur district are under safe category for ground water development point of view. No block has been notified by CGWA/SCWA,

9.0 Recommendation

1. The summarised data for pumping test proves that wells of 50 m depth can yield 20 – 25 m3/hr whereas wells down to 150 m can yield easily upto 200 m3/hr with a safe draw down.

2. Based upon pumping test data it has been inferred that a spacing of 200 m between shallow wells and 1000 m between deep tube wells can be safe to prevent interference during pumping.

3. As the district comes under Ganga plain, hydrogeologically the entire area is favourable for development of ground water through suitable ground water structures like shallow cavity wells, medium tube wells and deep tubewells. The dug wells, though they are also a good source for extraction of ground water in the area but as they do not sustain

throughout the year it is not advisable to rely upon them, however, the yield of these dug wells can be enhanced by using cavity boring.

4. Taking all aspects into consideration, it is clear that, in the district, the most suitable structures are shallow tubewells because they are more economical, the water loss will be less it is easier to maintain even by a small/marginal farmer.

5. As the canal in area is unlined, the water seepage is too much and it creates a lot of area near canal water logged. The Chaurs and Mauns (locally known name for low-lying area) are coming into existence due to meandering nature of river Burhi Gandak and the Baghmati as they change their flow path leaving on both sides of the bank, dead course. So to mitigate problems of water logging, lining of canals, provisions for surface drainage system, construction of embankment and ground water withdrawal on a large scale can be taken up as remedial measures. Afforestation also may be taken up in this regard. Especially to reclaim the submersed area from Mauns and Chaurs the fish farming can be done after developing these patches of land as fist pond. These remedial measures not only serve as source of production but it can improve the financial condition of poor farmers of the district.

DISTRICT : MUZAFFARPUR

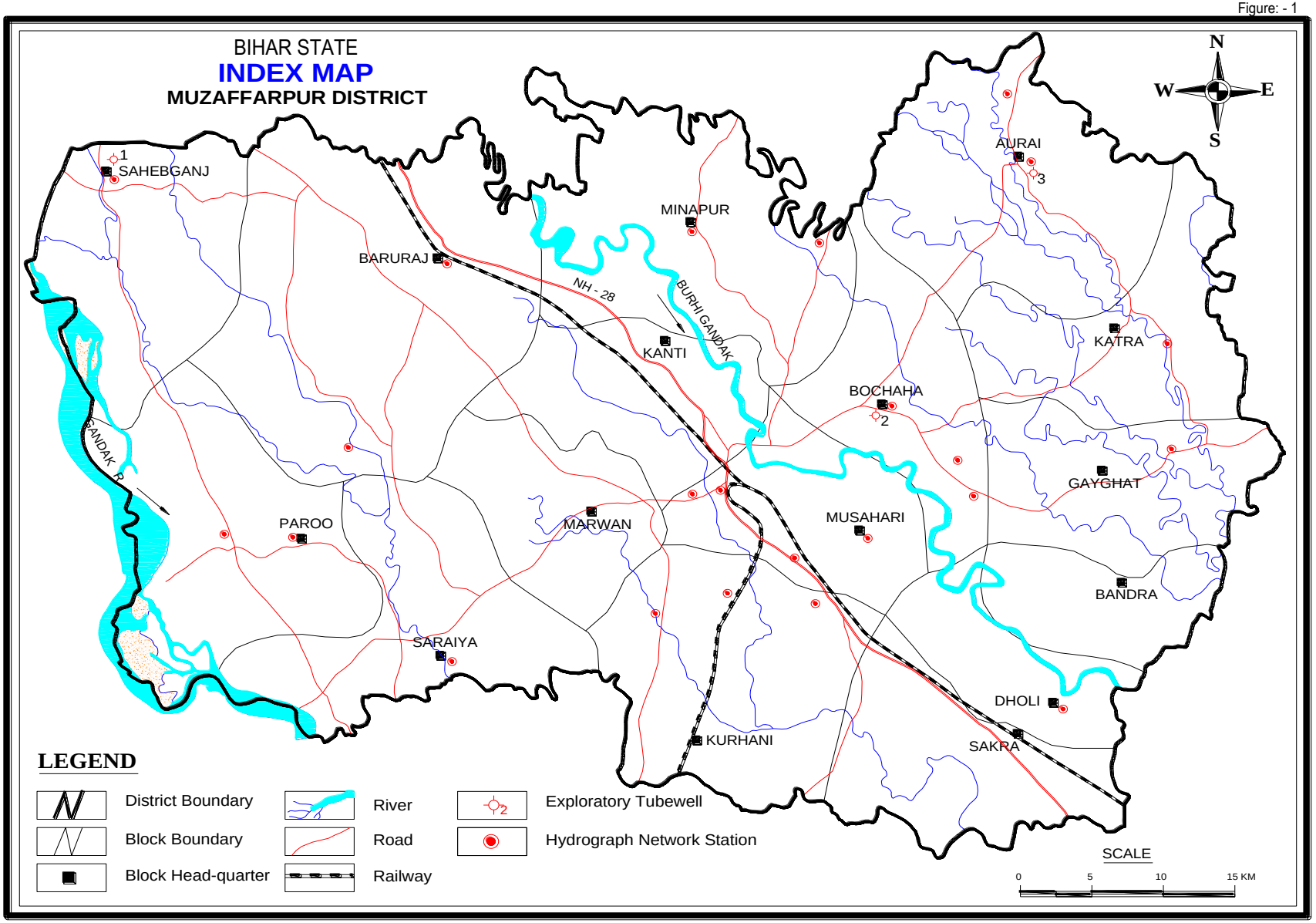
Sl.No.	Location/ Block	Depth Drilled mbgl.	Length of Casing pipe/ Depth const. m.	Granular/ Zone/ fracture Tapped m.	Static Water level m. bgl.	Discharge m^3/hr.	Drawdown m.	Specific Capacity m^3/hr./m.	Trans-missivity m^2/day	Storativity	Diameter of assembly mm.	Formation	Quality of Water	Year	Status of Handing Over	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14		15	16
1	**BOCHAHA/ BOCHAHA**	61	58	012.00-024.00	2.8	52.23	1.91		1636.5		203	ALLUVI-UM	POTABLE		Jun-84	FOC
	OW	43.1														
2	**AURAI/ AURAI**	55.5	52	022.00-031.00 034.00-042.00 045.00-052.00	2.52	49	3.14	15.6	1576	$2.60X10^{-3}$	203	-do-	-do-		May-85	FOC
	OW	55.55														
3	**SAHEB-GANJ/Sah-ebganj**	121.85	103	064.00-073.00 076.00-085.00 097.00-103.00	4.15	93.34	10.5	8.98	1274	$2.10X10^{-3}$	203	-do-	-do-		Dec-85	FOC
	OW	121.85														

Assessment of Dynamic Ground Water Resources of the Bihar state
Muzafferpur district as on 31st March 2009

(in hectare meter)

Sl.No	Assessment Unit/District	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft For all Uses (10+11)	Allocation for Domestic and Industrial Requirement Supply upto year 2025	Net Ground Water Availability for future irrigation development (9-10-13)	Stage of Ground Water Development (12/9)*100 (%)
1	2	9	10	11	12	13	14	15
1	Aurai	6288	2772	409	3180	640	2877	50.6
2	Bandra	3863	1876	188	2065	295	1692	53.4
3	Baruraj (Motipur)	8713	4206	629	4835	984	3523	55.5
4	Bochaha	5515	3179	324	3504	507	1828	63.5
5	Gaighat	6930	3476	357	3833	558	2896	55.3
6	Kanti	7445	2453	461	2915	722	4269	39.2
7	Katra	6024	2406	336	2742	526	3092	45.5
8	Kurahni	11499	5605	605	6210	947	4947	54.0
9	Minapur	8036	4723	455	5178	713	2601	64.4
10	Moraul (Dholi)	2089	1109	131	1240	205	775	59.3
11	Marwan	4279	1679	218	1897	341	2259	44.3
12	Mushari	4050	2259	1345	3603	1792	0	89.0
13	Paru	10023	3929	482	4411	754	5340	44.0
14	Sakra	5906	3310	426	3736	667	1929	63.3
15	Saraia	10032	3792	437	4229	684	5556	42.2
16	Shahebganj	6360	3378	322	3700	503	2479	58.2
	Total	**107052**	**50152**	**7126**	**57277**	**10839**	**46061**	53.5

Figure: - 1


BIHAR STATE
INDEX MAP
MUZAFFARPUR DISTRICT
N
W
E
S
1
SAHEBGANJ
BARURAJ
MINAPUR
AURAI
3
NH - 28
BURHI GANDAK
KANTI
KATRA
BOCHAHA
2
GAYGHAT
GANDAK R.
PAROO
MARWAN
MUSAHARI
BANDRA
SARAIYA
DHOLI
KURHANI
SAKRA
LEGEND
District Boundary
Block Boundary
Block Head-quarter
River
Road
Railway
Exploratory Tubewell
Hydrograph Network Station
SCALE
0
5
10
15 KM

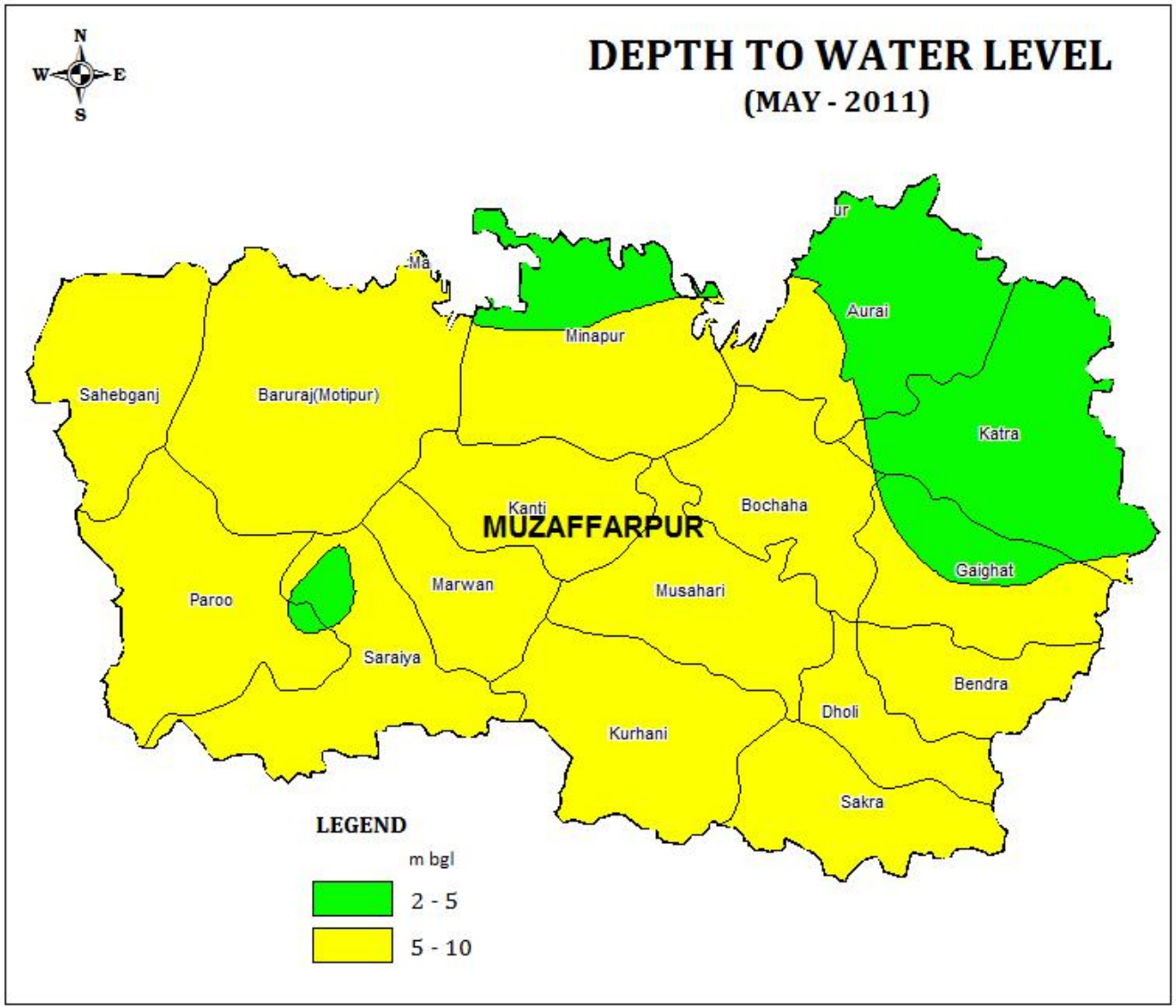


Fig. Depth to water level map of pre-monsoon 2011.

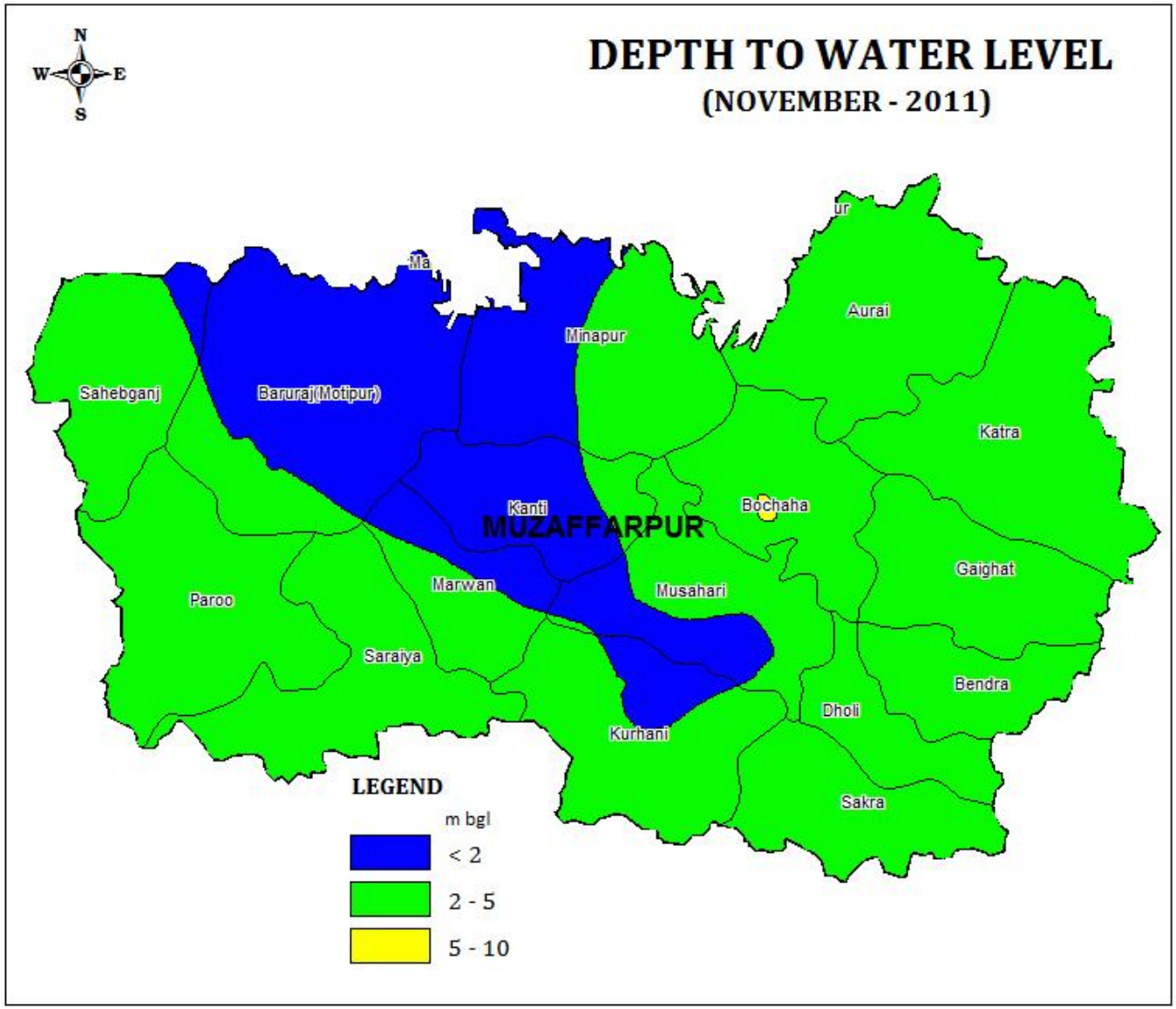


Fig. Depth to water level map of post-monsoon 2011.

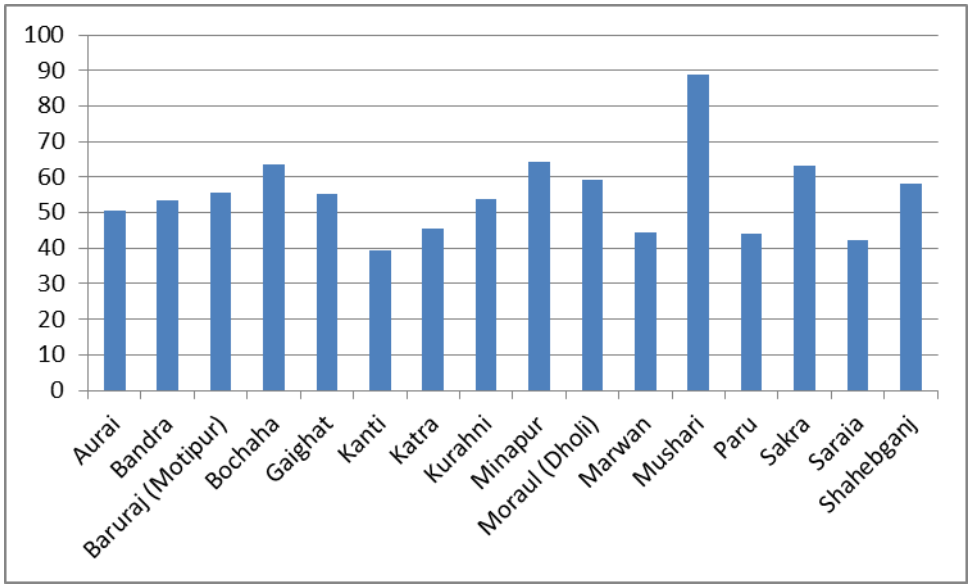


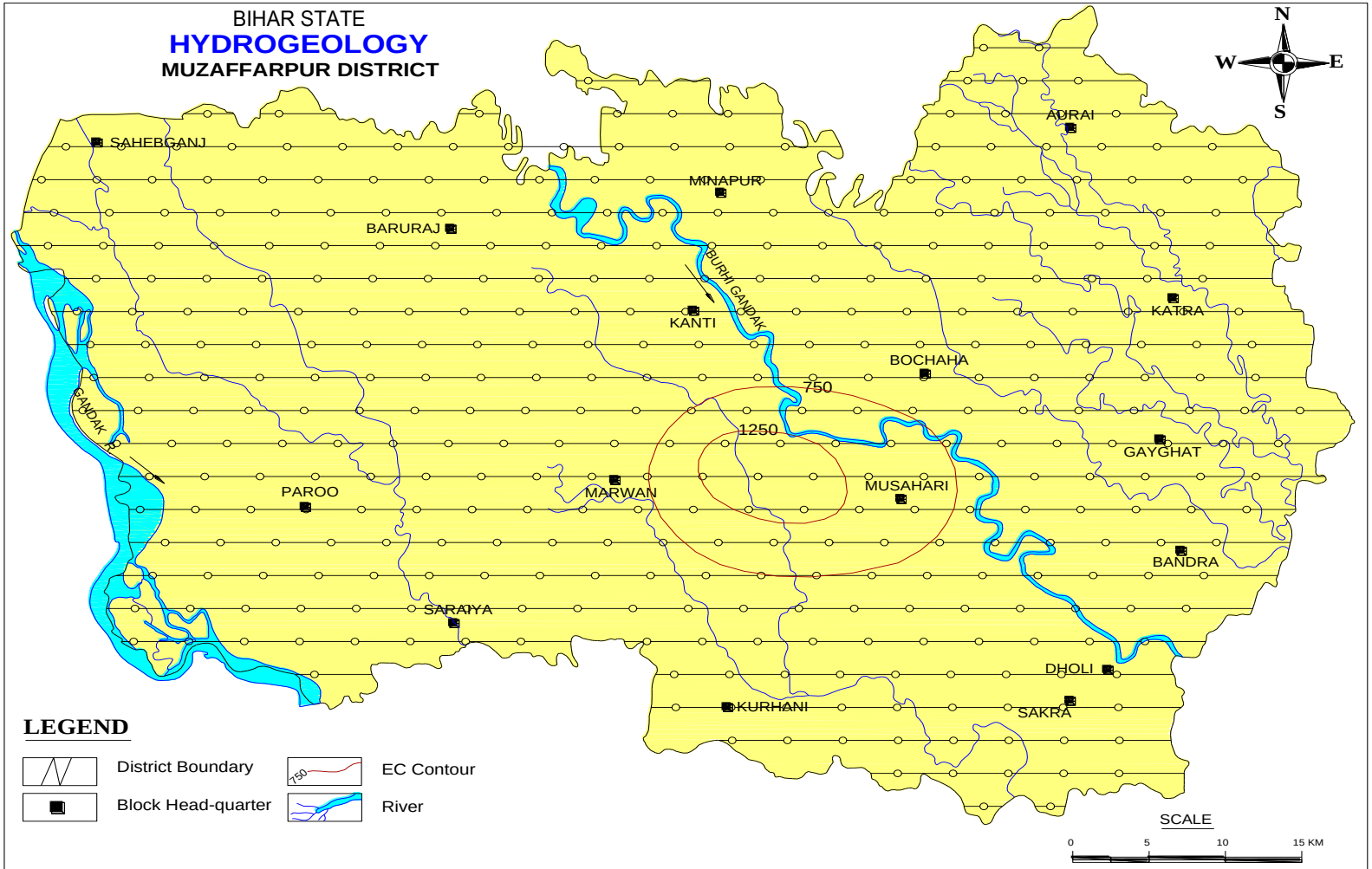
Fig. Blockwise stage of ground water development of the district.

Figure: - 5

BIHAR STATE

HYDROGEOLOGY

MUZAFFARPUR DISTRICT



FORMATION	AGE GROUP	LITHOLOGY	LANDFORM	SYMBOL	GROUND WATER POTENTIAL
Unconsolidated formation	Quaternary	Alluvium	Alluvial Plain		Moderate to good yield potential 40 - 200m³/hr.