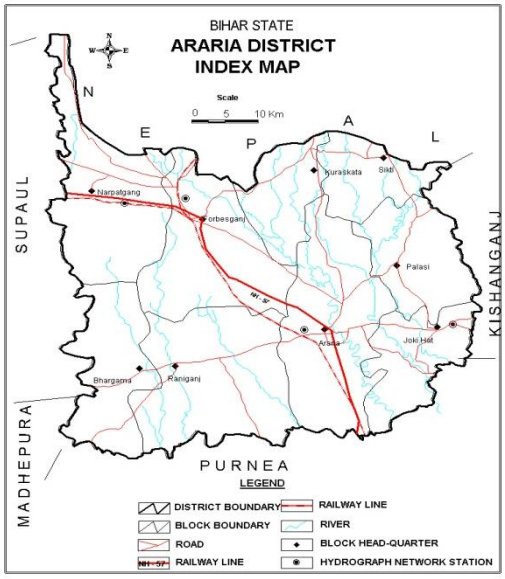
भूजल सूचना पुस्तिका

अररिया जिला, बिहार

Ground Water Information Booklet

Araria 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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ARARIA DISTRICT AT A GLANCE

Sl.No.	ITEMS	STATISTICS
1	**GENERAL INFORMATION**	
	i) Geographical area (Sq.km)	2830
	ii) Administrative Divisions Number of Tehsil/Block Number of Panchyat/Villages	2 9 218/742
	iii) Population (As on 2011 Census) Rural Urban	 2637656 168544
	iv) Average Annual Rainfall (mm)	1582
2	**GEOMORPHOLOGY**	
	Major physiographic units	Alluvial plain
	Major Drainages	Kosi, Suware, Koli, and Keli
3	**LAND USE (Hectares)**	
	a) Forest area:	838
	b) Net area sown:	1,60,251
	c) Total cropped area:	287060
4	**MAJOR SOIL TYPES**	Recent alluvium and calcareous soil
5	**PRINCIPAL CROPS**	Paddy, Wheat, Maize, Millet, Cereals and Vegetables
6	**IRRIGATION BY DIFFERENT SOURCES** (Area in hectares)	
	Dugwells	-
	Tube wells/Borewells	1,03,199
	Tank/ponds	-
	Canals	870
	Gross irrigated area	1,04,069
7	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (2011)**	
8	**No. of Dug wells**	03
9	**No. of Piezometers**	-
10	**PREDOMINANT GEOLOGICAL FORMATIONS**	Quaternary alluvium
11	**HYDROGEOLOGY**	
	➢ Major Water bearing formations ➢ Pre-monsoon Depth to water level during 2011 ➢ Post-monsoon Depth to water level during 2011 ➢ Long term water level trend in 10 years (2002-2011) in m/yr	Recent alluvium 2.5 – 4.3 mbgl 1.79 – 3.3 mbgl No significant change

12	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**	
	No. of wells drilled (EW, OW, PZ, SH, Total)	-
	Depth Range (m)	-
	Discharge (liters per second)	-
	Storativity (S)	-
	Transmissivity (m^2/day)	-
13	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limit (e.g., EC, F, Aa, Fe)	Iron
	Type of water	Potable
14	**DYNAMIC GROUND WATER RESOURCES (as on 31st March 2009) – in mcm**	
	Annual Replenishable Ground Water Resources	803.97
	Net Annual Ground Water Draft	256.15
	Projected Demand for Domestic and Industrial Uses upto 2025	61.04
	Stage of Ground Water Development	31.9%
15	**AWARENESS AND TRAINING ACTIVITY**	
	Mass Awareness Programmes organized Date Place No. of participants	NIL
16	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No. & Amount spent)	-
	Projects under technical guidance of CGWB (Numbers)	-
17	**GROUND WATER CONTROL AND REGULATION**	
	No. of OE Blocks	-
	No. of Critical Blocks	-
	No. of Blocks notified	-
18	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Water logging and excess Iron in ground water

Ground Water Information Booklet
Araria District, Bihar State

CONTENTS

GROUND WATER INFORMATION BOOKLET

ARARIA DISTRICT, BIHAR STATE

1.0 Introduction

Araria has a very prestigious past though shrouded in midst of uncertainties and termed as a place of confluence of three entirely different cultures. In the year 1765 the area come under the Dewani of East India Company. This district was one of the sub-division of undivided Purnea district. Araria district came into existence on the Makar-Sankranti day of 1990 after the bifurcation of undivided Purnea district in Purnea, Kishanganj and Araria. The district has its headquarter at Araria.

Araria has huge ground water potential that can be exploited to increase the cropping intensity. The ground water information booklet of the district, prepared as a part of one of the activities of the "Water Year 2007", contains information, in brief, pertaining to administrative set-up, climate, irrigation practises, geomorphology, soils, hydrogeology and ground water potential.

1.1 Administration

Araria is situated in the northeastern corner of Bihar state having its international boundary with Nepal in the north. Supaul district is in the west, Madhepura district is in the southwest, Purnea districts is in the south and Kishanganj district is in the east. The Araria district is situated between latitudes $25^0$56'30" to $26^0$35'15" north and longitude $87^0$02'30" to $87^0$42'45" east in the Survey of India Toposheet nos. 72 N & 72 O with geographical area of 2830 Km^2. The district divided into 2 civil sub-division, 9 community development blocks, 218 Punchayats and 712 villages. The total population of district is 2806200 in this Rural 2637656 & Urban 168544 (2011 census). The district boundaries, administrative divisions, major roads, rivers, and HNS locations are presented in Fig 1.

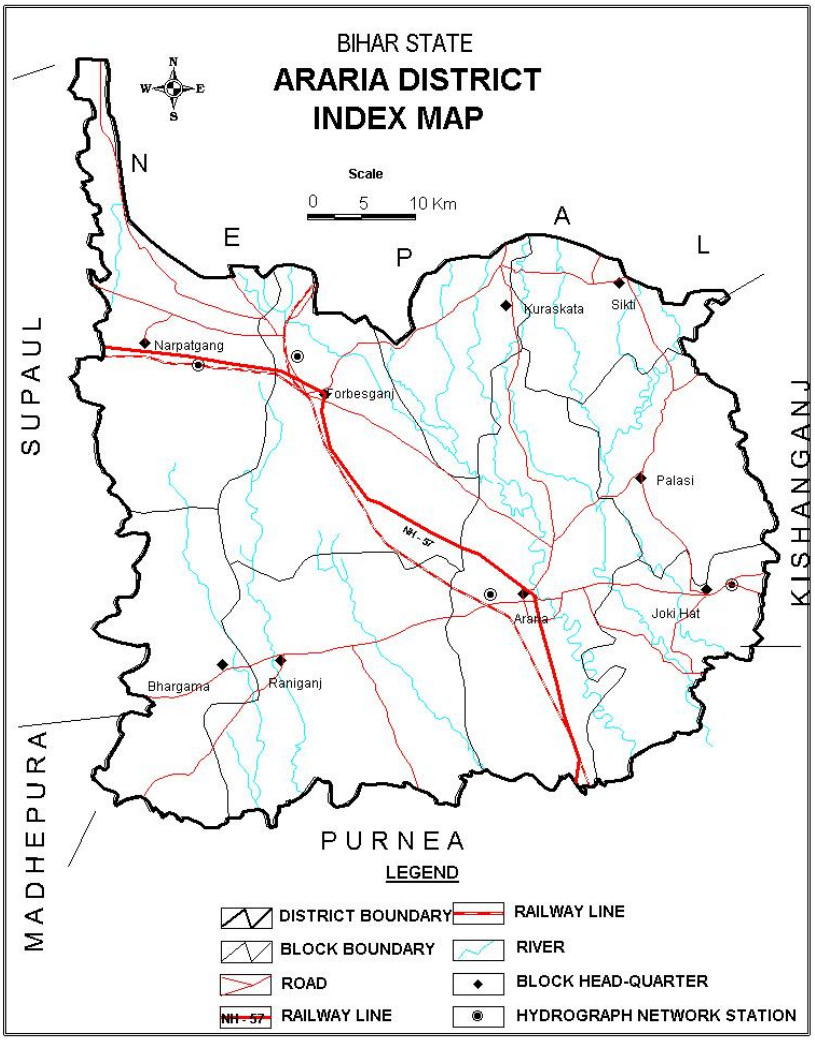

Fig. 1 Index map of Araria district

1.2 Basin/sub-basin, Drainage

The district falls in the Kosi and Mahananda sub-basin of Lower Ganga basin. Kosi and its tributaries with Kosi dhars drain the district, Out of 9 blocks 6 blocks marked by the presence of Kosi dhars. Kosi Dhars are abandoned channels of river Kosi, left behind in course of its migration. They originate at different places and flow in the south direction and effluent in nature. Small rivers coming down from Nepal confluence in the north of the district to make the rivers Parman Nadi, Katua Dhar, Ratua Nadi etc., which flow in the southern direction.

Kosi and its tributaries exhibit dichotomic drainage pattern. Drainage pattern in the district is sub-parallel in general.

1.3 Irrigation practices

There are four cropping season in the district. Bhadai and Aghani from Kharif season followed by Rabi and Garma. Out of 265,000 hectare total cropped area, contribution from Bhadai is 64,000 hectare, Aghani is 103,000 hectare, Rabbi is 63,000 hectare and Garma is 30,000 hectare (1998-1999). The cropping intensity is 147%.

Irrigation from both surfaces and ground water is being practised in the district. The Western part of the district is covered under Eastern Kosi canal command area. The main canals terminate in Araria district while its branch canals pass through the district. The irrigation from ground water is mainly through diesel operated pumps. The other sources of irrigation, on a limited scale includes, lifting of water from river and nala with the help of centrifugal pumps. Out of 104,069 hectare total gross irrigated area, contribution from tube-wells is maximum 1,03,199 hectare, followed by canals 870 hectare.

1.4 Studies/Activities of CGWB

Central Ground Water Board has surveyed the entire district under systematic hydrogeological survey. District hydrogeological report has been issued.

There are 4 HNS monitoring stations in the district, which monitored 4 times in a year.

2.0 Climates and Rainfall

The district experienced three different season viz., summer from March to early June, rainy from later part of June to September and winter from November to Feburary. Mean daily ambient temperature in summer shoots upto 40^0C and in winter mean daily ambient temperature falls down to 4^0C. The relative humidity is generally above 70% in most part of the year.

Rainfall in the district is mainly by southwest monsoon, which sets in the month of June and continues upto September. Some times monsoon retreats in early October. The average annual rainfall for 2004 is 1582 mm. The district receives 85% of the rainfall during the southwest monsoon.

3.0 Geomorphology and Soil types

The district has a monotonous flat topography with gentle slope in the southeast direction. The regional topographic gradient in the northern part of the district is about 0.5 m/Km and and reduces to 0.2 m/Km in the southern part. The maximum relief in the district is 71.3 m amsl near Ghurna and the minimum is 45.3 m amsl near Jokihat.

Soil

The two broad soil groups are available in the district.

a) Recent Alluvium non-calcareous non-saline groups found over major part of the district. It is mostly light to medium textured and acid to neutral in nature. It also formed layered sediments having no horizontal differentiation.

b) Recent Alluvium-Tarai soils found as a small patch in the northeast corner of the district. It is mixture of highly disturbed recent alluvium along the course of river. It is light to heavy textured and poorly drained.

4.0 Ground Water Scenario

4.1 Hydrogeology

The district is underlain by thick unconsolidated sediment of Quaternary period. Geological survey of India has given the following classification based on nature of alluvial deposits

System	Series	Formation	Lithology
Quaternary	Upper Holocene	Diara Formation	Alteration of fine grey silt and clay
	Unclassified Holocene	Kosi Formation	Grey silt and clay alteration with fine to medium sand
		Purnea Formation	Pale yellow to grey silt and silty clay, fine sand, grey medium to coarse sand with thin partings of sand and fine silt

Mode of Occurrence of Ground Water

Quaternary unconsolidated sediments consisting of sand, gravel and pebbles constitute potential ground water repository. Shallow aquifer is about 40-70 meters within a depth of 80 meters. A thin veneer of clay is present overlying the granular zone in the northern part of the district. Though lateral facies changes have been observed, the

aquifer system behaves as single continuous one. The aquifers are highly potential and yield 200m^3/hr for nominal drawdown of 2 m.

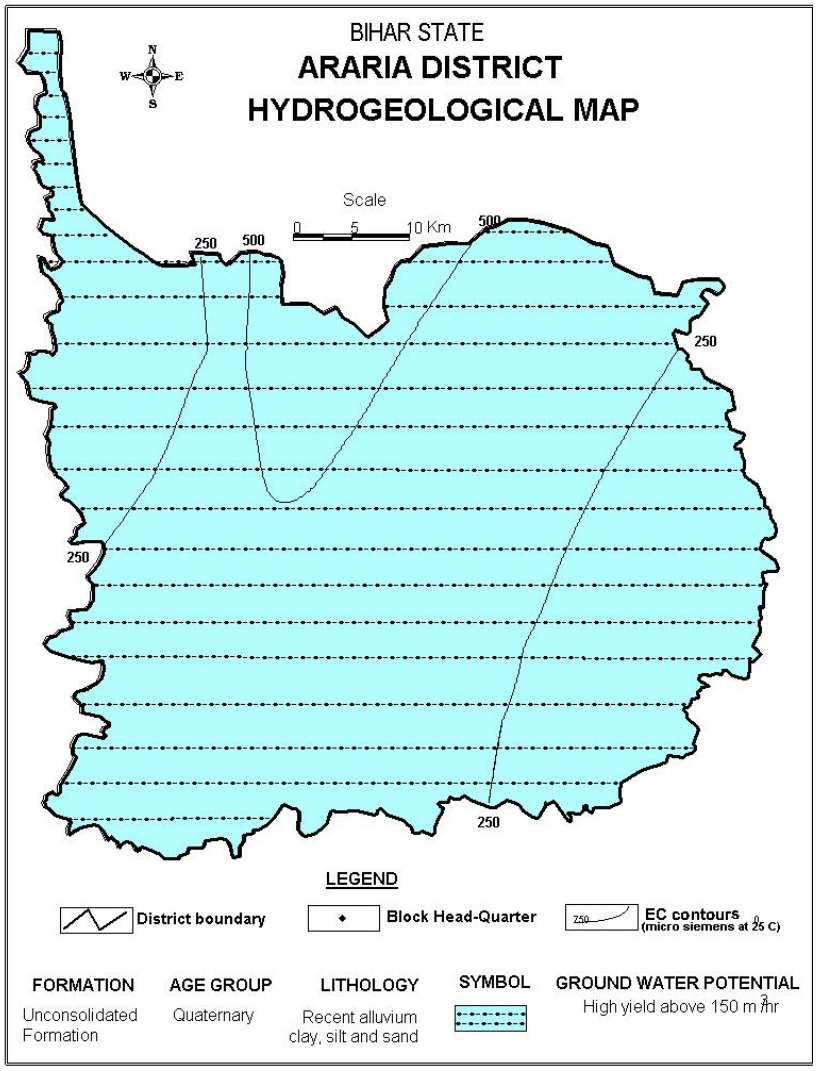

Fig 2. Hydrogeological map of Araria district

Water Level Fluctuation

The pre-monsoon (May 2011) water level is within the 4.2 m bgl (Fig. 3) and post-monsoon (November 2011) water level with in 3.3 m bgl (Fig. 4) in major part of the district. The seasonal fluctuation of pre and post monsoon data of 2011 show rise 0.93 m. The long-term water level data does not show any significant changes. The season wise, annual and long term (decadal) fluctuations of water level are given in Table 1.

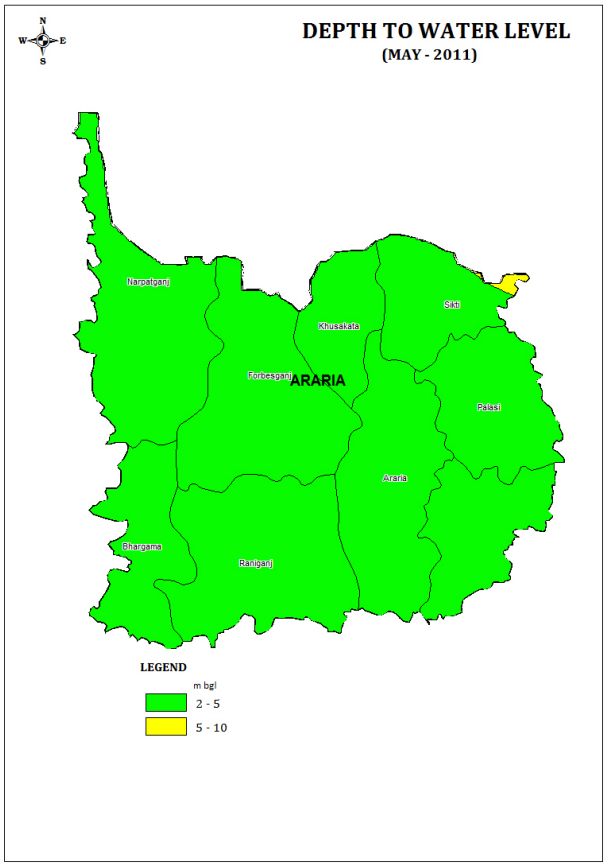

Fig 3. Pre-monsoon (May 2011) water level map of Araria district

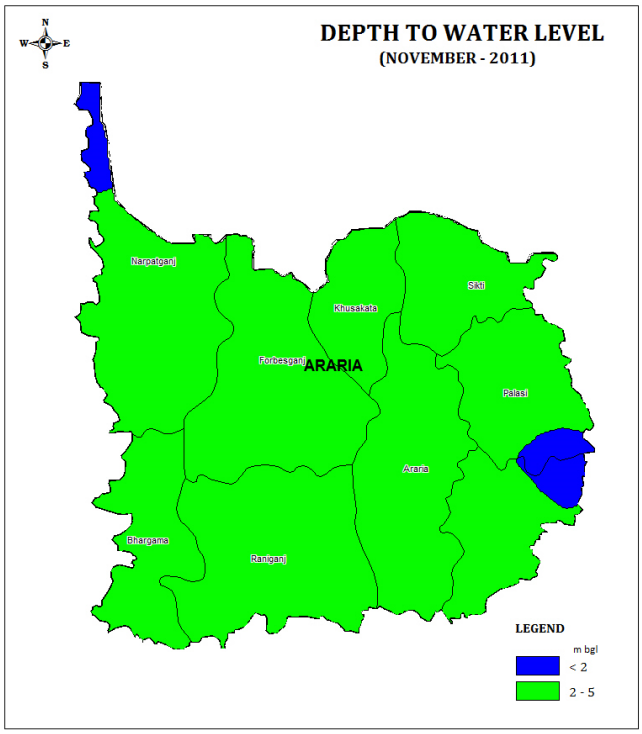

Fig 4. Post-monsoon (November 2011) water level map of Araria district

Table 1: Long term (decadal), Annual and SeasonalWater Level Fluctuation of Araria district for year 2011

Long term fluctuation of water level (2001-2011)																		
Sl. No.	**Period**	**No. of wells Analysed**	**Range of Fluctuation**				**Rise**						**Fall**					
			Rise		**Fall**		**0-2 m**		**2-4 m**		**>4m**		**0-2 m**		**2-4 m**		**>4m**	
			min	**max**	**min**	**max**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1	May 11 - May Decadal	3	0.04	0.04	0.62	0.62	1	33	0	0	0	0	2	67	0	0	0	0
2	Nov 11 - Nov Decadal	2	0.31	0.31	0.06	0.06	1	50	0	0	0	0	1	50	0	0	0	0
3	Jan 12 - Jan Decadal	2	0	0	0.37	0.44	01	0	0	0	0	0	2	100	0	0	0	0
Annual fluctuation of Water level																		
Sl. No.	**Period**	**No. of wells Analysed**	**Range of Fluctuation**				**Rise**						**Fall**					
			Rise		**Fall**		**0-2 m**		**2-4 m**		**>4m**		**0-2 m**		**2-4 m**		**>4m**	
			min	**max**	**min**	**max**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1	May 10 - May 11	3	0	0	0.05	0.28	0	0	0	0	0	0	3	100	0	0	0	0
2	Nov 10 -Nov 11	2	0.21	0.21	0.18	0.18	1	50	0	0	0	0	1	50	0	0	0	0
3	Jan10 - Jan 11	2	0.8	0.8	0.35	0.35	1	50	0	0	0	0	1	50	0	0	0	0
Seasonal fluctuation of Water level																		
Sl. No.	**Period**	**No. of wells Analysed**	**Range of Fluctuation**				**Rise**						**Fall**					
			Rise		**Fall**		**0-2 m**		**2-4 m**		**>4m**		**0-2 m**		**2-4 m**		**>4m**	
			min	**max**	**min**	**max**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1	May 11-Nov 11	2	0.71	0.93	-	-	2	100	0	0	0	0	0	0	0	0	0	0
2	May 11 – Jan 12	2	0.2	0.34	-	-	2	100	0	0	0	0	0	0	0	0	0	0

4.2 Ground Water Resources

The net annual replenishable ground water resource as on 31st March'09 works out to be 80397 ha m. The gross annual draft for all uses works out to be 25615 ha m. Allocation of ground water for domestic and industrial use for 25 years works out to be 6105 ha m. The stage of ground water development is 31.9%. The stage of ground water development is highest in Bhargawan (59.6%) and lowest in the Raniganj (21.3%). As stage of ground water development in all the blocks are less than 70%, and there is no long-term decline in water levels, all the blocks are under safe category. The stage of groundwater development is depicted in Fig 5. The block-wise ground water resource is given in Table 2.

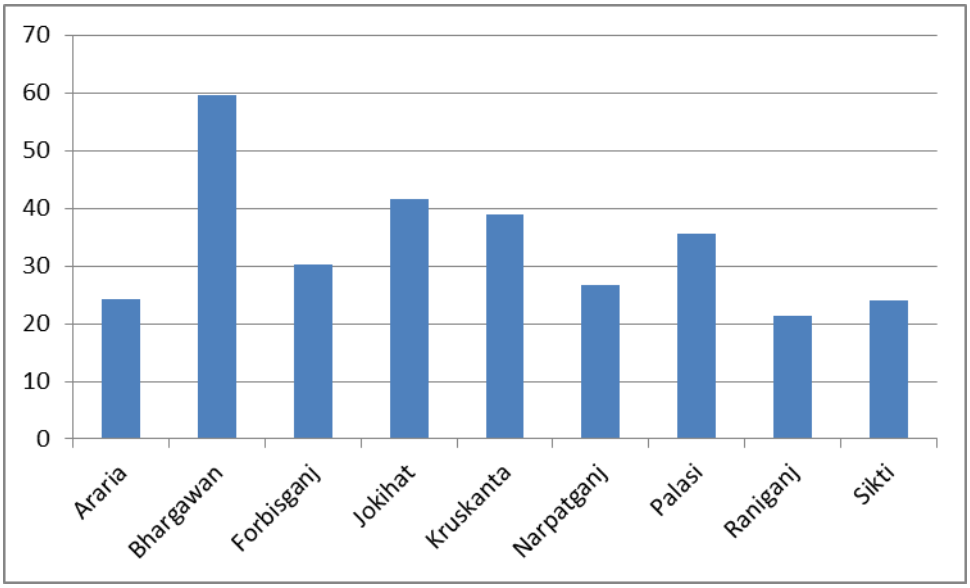

Fig 5. Blockwise Stage of Ground Water Development of Araria district

Table 2: Blockwise dynamic ground water resource of Araria district (As on 31st March 2009, in ha m).

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	Araria	11333	1848	908	2756	1005	8480	24.3
2	Bhargawan	7591	4195	328	4523	511	2885	59.6
3	Forbisganj	12377	2760	987	3746	1056	8560	30.3
4	Jokihat	7727	2760	448	3208	696	4271	41.5
5	Kruskanta	4908	1693	211	1903	327	2888	38.8
6	Narpatganj	11028	2451	492	2943	764	7813	26.7
7	Palasi	6903	2104	346	2450	538	4261	35.5
8	Raniganj	13401	2310	550	2861	855	10235	21.3
9	Sikti	5130	998	226	1224	351	3781	23.9
	Total	**80397**	**21120**	**4496**	**25615**	**6104**	**53174**	**31.9**

4.3 Chemical Quality of Ground Water

Chemical quality of water is important in deciding the suitability for irrigation, industrial and drinking purposes. Chemical analysis of ground water of phreatic aquifer is found suitable for drinking and irrigation purposes. The ground water is mildly alkaline

in nature having pH above 8.0. Electrical conductivity (EC) is in the range of 250 – 450 micro seimens/cm. All the major parameters are within the permissible limit. However, Public Health Engineering Department (PHED), Araria division, Araria, Government of Bihar reported iron content more than its permissible limit of 1.0 ppm (BIS, 1991) in all the 9 blocks. It is advisable to adopt iron-removal measures before the utilization of ground water for drinking purposes.

4.4 Status of Ground Water Development (Blockwise)

The entire district is underlain by prolific and regionally extensive aquifers of huge thickness. The district receives abundant rainfall, which recharge the aquifers. As per the minor irrigation census data, there were 13652 shallow tube wells were available for the irrigation. Additional 3410 shallow tube wells were sunk in the district upto 2004 under "Million Shallow tube well" programme. About 75% of the total irrigated land is served with the ground water. The irrigation from ground water is mainly with the diesel operated pumps. The shallow tube wells drilled with bamboo boring technique is most common in the region. The shallow tube well upto depth range of 20-40 m may yields 75 –100 m^3/hr.

5.0 Ground Water Management Strategy

The district is rich in ground as well as surface water resources. The conjunctive use of surface and ground water will provide better ground water management strategy.

5.1 Ground Water Development

The aquifer system present in the district is highly potential. A shallow tube well with in the depth range of 20-40 m, tapping granular zone of 10-15 mbgl and 25-30 mbgl respectively can yield as high as 75 m^3/hr. A well assembly of 76 mm diameter or 102 mm diameter with 5 to 10 m of slotted pipes can be used for construction of tube wells. Deep tube wells can be constructed by tapping potential aquifer present in the depth range of 50-80 m bgl. A well down to a depth of 70-100 meters tapping the aquifer of 50-80 m bgl can yield on an average of 180 m^3/hr discharge for nominal drawdown. The slot size should be recommended as per the grain size. For medium to coarse-grained sand the slot opening may be 1/16". The wells should be properly shrouded with pea size gravel of

2 to 5 mm. The distance between two shallow tube wells should be 150 to 200 m and between two deep tube wells may be 500 to 600m for safe discharge.

.5.2 Water conservation and Artificial Recharge

All the blocks of the district fall under the safe category. The need for water conservation and artificial recharge need not be over emphasized in canal command area. Available groundwater resources indicate that the block falling in the canal command area have high ground water resource and low draft, resulting in shallow water level in pre-monsoon period and become water logged during post monsoon period. Exploitation of ground water in these blocks would push the water level to desirable depth. De-siltation of canals and control of seepage will enhance the irrigation potential of these canals especially in the tail end of the canal command area.

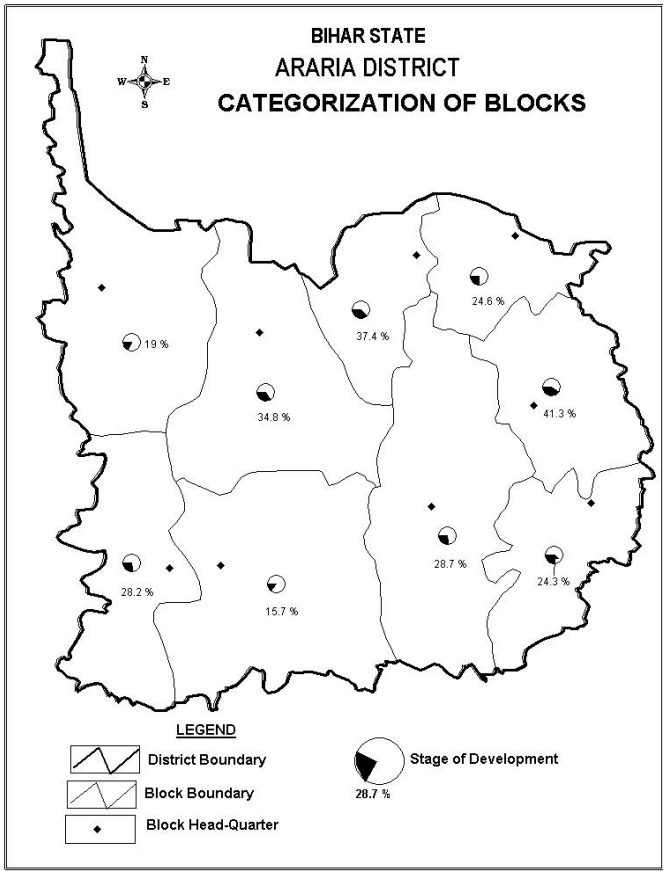

Fig 6: Categorisation of blocks

6.0 Ground Water Related Issue and Problems

The iron content is more than its permissible limit in all the blocks of the district as reported by PHED, Araria division, Government of Bihar. The ground water is charged

with high iron because of ferrogeneous material deposited by the river along with sand. The iron removal measures should be taken before the use of ground water with high iron. The other problem in the district is water logging in the canal command area.

7.0 Mass Awareness and Training Activity

Mass Awareness Programme (MAP) and Water Management Training Program (WMTP) have yet to be organized in this district.

8.0 Area notified by CGWA / SGWA

All the blocks falls in safe category, and there is not significant long-term decline in ground water level in any of the HNS located in the districts. As such no block has been notified.

9.0 Recommendation

1. Ground water development in the district can be made with the help of shallow tube well, bamboo borings and deep tube well.
2. Chemical quality of ground water is found suitable for drinking and irrigation purposes. However, high iron content has been observed in the entire district. The ground water should be treated for iron before supplying for domestic use.
3. Extended use of ground water should be made for the area falling under the Eastern Kosi command area for minimizing water logging.
4. Diesel operated pump sets enhances the lifting cost of tubewell water. In order to reduce the financial burden, alternative low cost energy should be provided for the energisation of pumps.
5. Non-conventional energy resource can be used for the energisation of pumpsets, where it seem feasible.