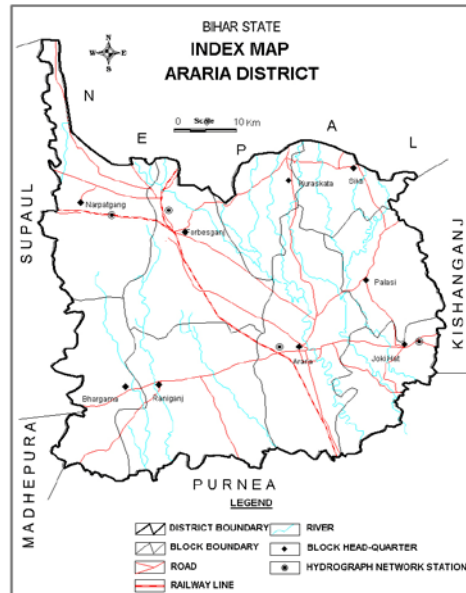




स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

CONSERVE WATER - SAVE LIFE

Ground Water Information Booklet Araria District, Bihar State



Central Ground Water Board

Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region
PATNA

March, 2008

PREPARED BY - Dr. Raj Kumar Singh, AHG
UNDER SUPERVISION OF - Dr. K.K.Singh, Scientist'D' &
Sri A. K. Agrawal Scientist'D'

ARARIA DISTRICT AT A GLANCE

Sl.No.	ITEMS	STATISTICS
1	GENERAL INFORMATION	
	i) Geographical area (Sq.km)	2830
	ii) Administrative Divisions (As on 2001)	2
	Number of Tehsil/Block	9
	Number of Panchyat/Villages	218/742
	iii) Population (As on 2001 Census)	16,11,638
	iv) Average Annual Rainfall (mm)	1582
2	GEOMORPHOLOGY	
	Major physiographic units	Alluvial plain
	Major Drainages	Kosi, Suware, Koli, and Keli
3	LAND USE (Hectares) 2004 – 2005	
	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 (As on 31-3-2007)	
8	No. of Dug wells	4
9	No. of Piezometers	-
10	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary alluvium
11	HYDROGEOLOGY	
	➤ Major Water bearing formations	Recent alluvium
	➤ Pre-monsoon Depth to water level during 2006	2 – 6 mbgl
	➤ Post-monsoon Depth to water level during 2006	1 – 3 mbgl
	➤ Long term water level trend in 10 years (1997-2006) in m/yr	No significant change

12	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2007)	
	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 (2004) – in mcm	
	Annual Replenishable Ground Water Resources	941.06
	Net Annual Ground Water Draft	239.03
	Projected Demand for Domestic and Industrial Uses upto 2025	54.78
	Stage of Ground Water Development	27%
15	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized Date Place No. of participants	-
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

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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 25⁰56'30" to 26⁰35'15" north and longitude 87⁰02'30" to 87⁰42'45" east in the Survey of India Toposheet nos. 72 N & 72 O with geographical area of 2830 Km². The district divided into 2 civil sub-division, 9 community development blocks, 218 Panchayats and 712 villages (2001 census). The total population of district is 21,58,608 (Rural 20,26,257 Urban 1,32,351). The SC population is 2,93,488 (Rural 2,80,653 Urban 12,835), and ST population is 29,423 (Rural 29,106 Urban 317). The population density is 763 person/Km² and sex ratio is 913 females/1000 males. Araria is having population of 60,861, Forbesganj is having population of 41,499 and Jogbani with a population of 29,991 are the towns in the district (2001 census). The district boundaries, administrative divisions, major roads, rivers, and HNS locations are presented in Fig 1.

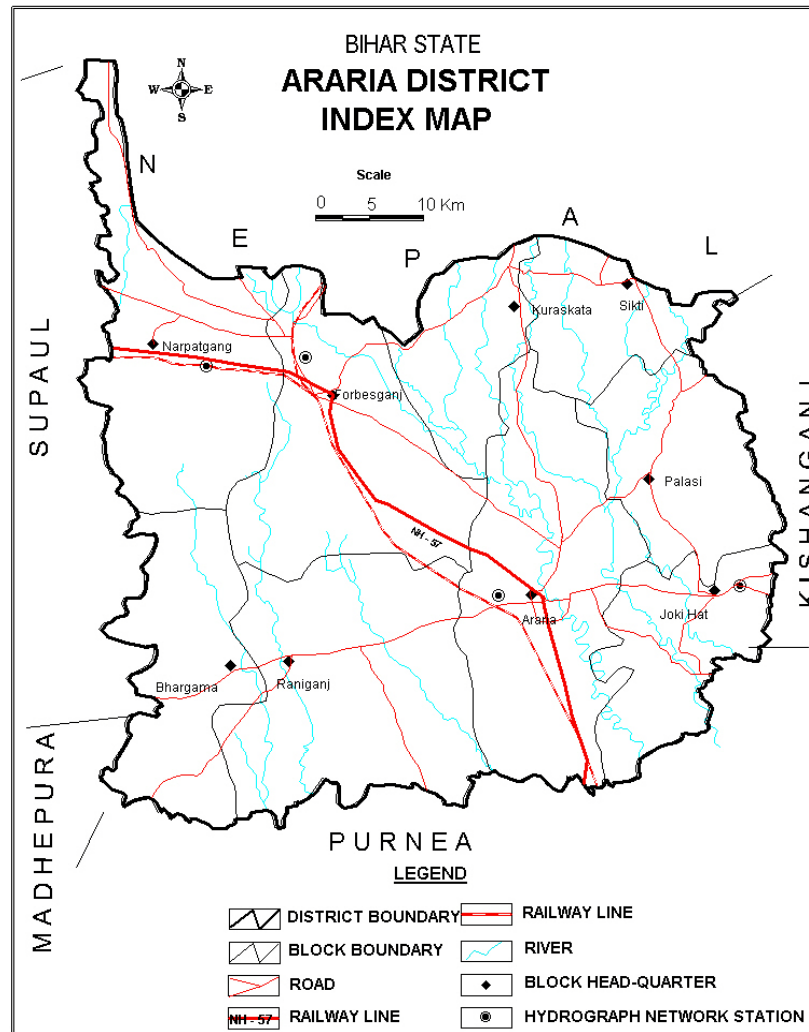


Fig. 1 Index map of Araria district

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 February. Mean daily ambient temperature in summer shoots upto 40⁰C and in winter mean daily ambient temperature falls down to 4⁰C. 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 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 $200\text{m}^3/\text{hr}$ for nominal drawdown of 2 m.

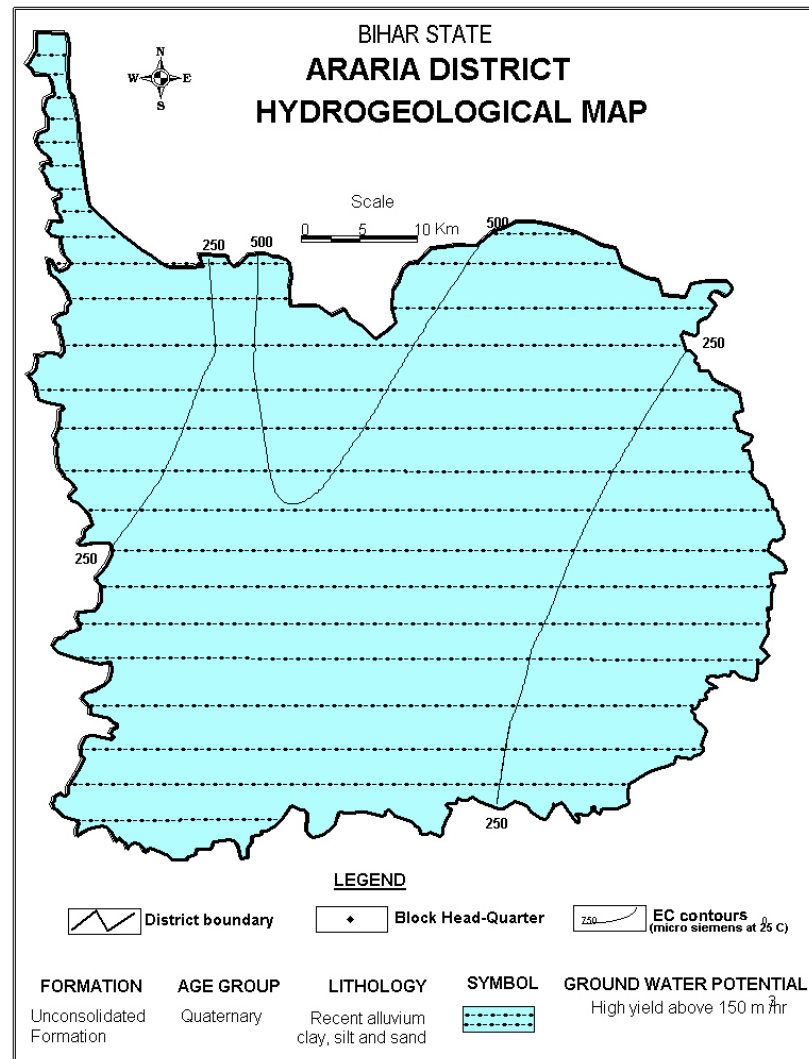


Fig 2. Hydrogeological map of Araria district

Water Level Fluctuation

The pre-monsoon (May 2006) water level is within the 5 m bgl (Fig. 3) and post-monsoon (November 2006) water level within 2.5 m bgl (Fig. 4) in major part of the district. The seasonal fluctuation of pre and post monsoon data of 2006 show rise 2.89 m. The May 2006 (Pre-monsoon) water level fluctuation with respect to May 2005 shows rise of 0.22 m. The November 2006 (Post monsoon) water level fluctuation with respect to November 2005 shows rise of 2.34 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.

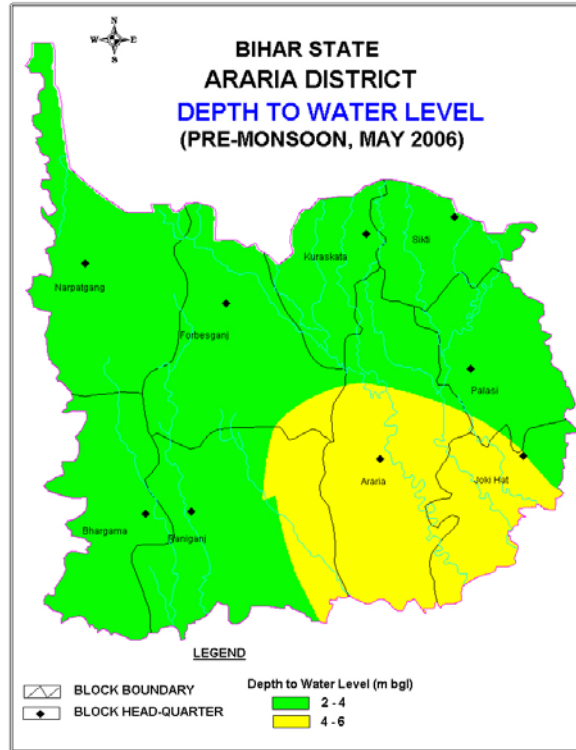


Fig 3. Pre-monsoon (May 2006) water level map of Araria district

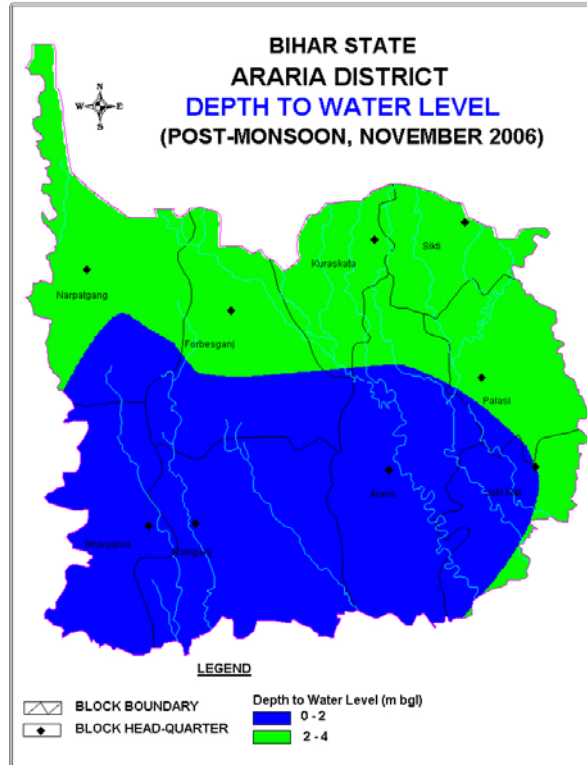


Fig 4. Post-monsoon (November 2006) water level map of Araria district

Table 1: Long term (decadal), Annual and Seasonal Water Level Fluctuation of Araria district

for year 2006

Long term fluctuation of water level (1997-2006)																				
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 06 - May Decadal	1	-	-	-	-	0	0	0	0	0	0	0	0	1	100	0	0	0	0
2	Nov 06 - Nov Decadal	2	2.05	2.05	0.80	0.80	0	0	1	50	0	0	0	0	1	50	0	0	0	0
3	Jan 07 - Jan Decadal	3	0.29	0.29	0.08	0.67	1	33.33	0	0	0	0	0	0	2	66.67	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 05 - May 06	1	0.22	0.22	-	-	1	100	0	0	0	0	0	0	0	0	0	0	0	0
2	Nov 05 -Nov 06	1	2.34	2.34	-	-	0	0	1	100	0	0	0	0	0	0	0	0	0	0
3	Jan05 - Jan 06	1	0.66	0.66	-	-	1	100	0	0	0	0	0	0	0	0	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 06-Nov 06	1	2.89	2.89	-	-	0	0	1	100	0	0	0	0	0	0	0	0	0	0
2	May 06-Jan 07	1	1.04	1.04	-	-	1	100	0	0	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'04 works out to be 88,340 ha m. The gross annual draft for all uses works out to be 23,903 ha m. Allocation of ground water for domestic and industrial use for 25 years works out to be 5,478 ha m. The stage of ground water development is 27.1%. The stage of ground water development is highest in Palasi (41.3%) and lowest in the Raniganj (15.7%). 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 dynamic ground water resource is depicted in Fig 5. The block-wise ground water resource is given in Table 03.

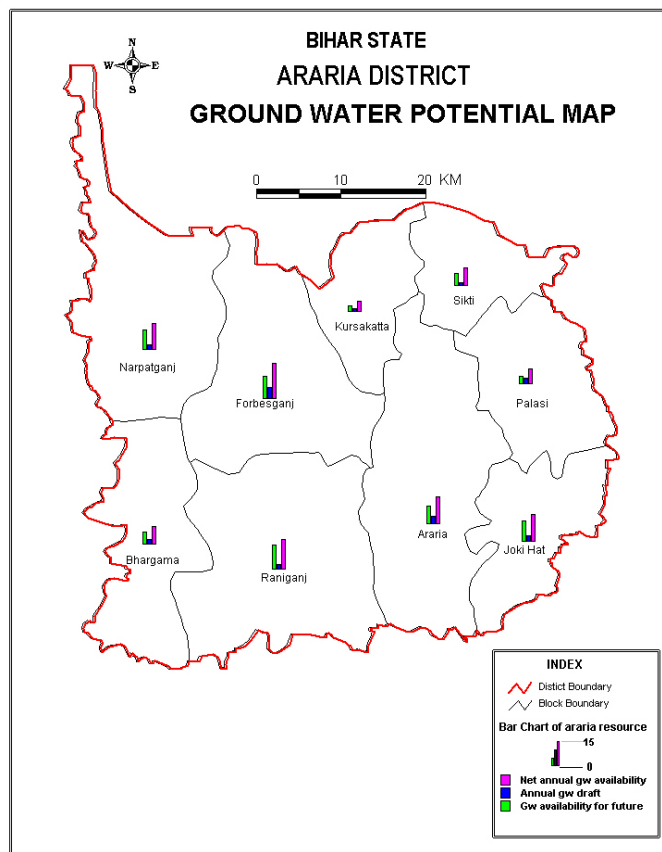


Fig 5. Ground water potential map of Araria district

Table 2: Blockwise dynamic ground water resource of Araria district
(As on 31st March 2004, 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 next 25 years	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	11564.6	2749.7	569.0	3318.7	913.8	7901.1	28.7
2	Bhargawan	7714.3	1889.2	288.3	2177.5	465.1	5360.0	28.2
3	Forbisganj	14858.7	4496.2	675.7	5171.9	960.6	9401.9	34.8
4	Jokihat	11793.4	2493.9	370.8	2864.7	598.1	8701.4	24.3
5	Kruskanta	4668.3	1560.6	184.7	1745.3	297.9	2809.7	37.4
6	Narpatganj	10850.7	1643.7	412.6	2056.3	665.6	8541.4	19.0
7	Palasi	6463.4	2371.4	299.8	2671.2	483.6	3608.3	41.3
8	Raniganj	12635.3	1502.8	479.4	1982.2	773.3	10359.2	15.7
9	Sikti	7791.0	1716.4	198.2	1914.7	319.8	5754.8	24.6
	Total	88339.5	20424.1	3478.5	23902.5	5477.7	62437.7	27.1

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 2000 – 01 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 (1998-1999). 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 m³/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 m³/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 m³/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.

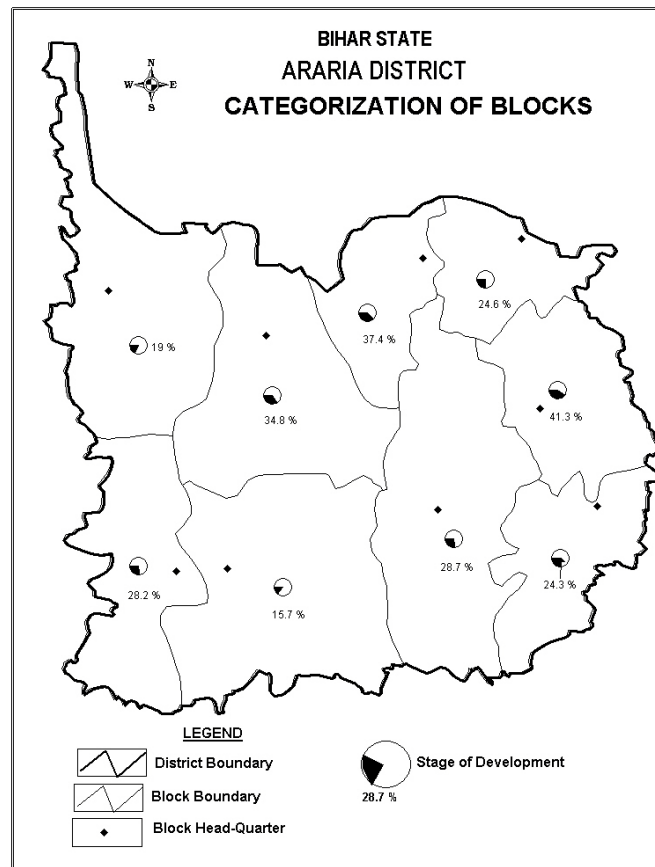


Fig 6: Categorisation of blocks and artificial recharge prospects

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.