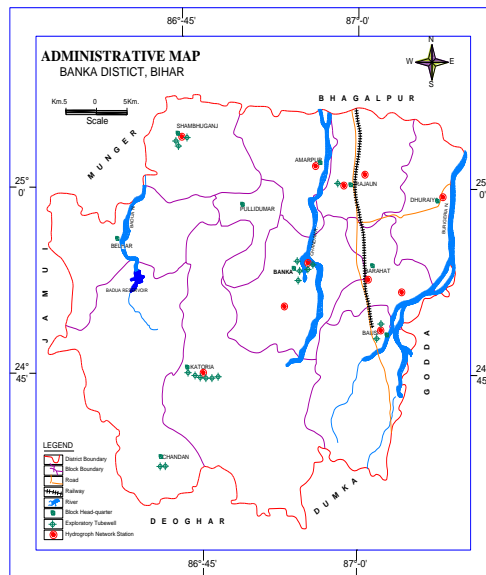




भूजल सूचना पुस्तिका

बाँका जिला, बिहार

Ground Water Information Booklet
Banka 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
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Ground Water Information Booklet
Banka District, Bihar
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BANKA DISTRICT AT A GLANCE

Sl. No.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i) Geographical area (SqKm)	3019
	Administrative Division	
	i) Number of Tehsil/ Block	11
	ii) Number of Panchyat/Villages	199/2131
	iii) Population (As on 2011 Census)	2029339
	iv) Average Annual Rainfall (mm)	1168
2.	GEOMORPHOLOGY	
	Major physiographic unit :	Alluvial Plain, Hills & Pediments
	Major Drainages:	Chandan, Badua & Burigeria rivers
3.	LAND USE (SqKm)	
	a) Forest area:	460
	b) Net area sown:	1460
	c) Cultivable area:	1730
4.	MAJOR SOIL TYPE	
5.	AREA UNDER PRINCIPAL CROPS	
6.	IRRIGATION BY DIFFERENT SOURCES	Area(SqKm)
	(Areas in Hectare and Number of Structures)	
	Dugwell	20
	Tubewell/Borewell	270
	Tank/ponds	190
	Canals	330
	Other sources	340
	Net irrigated area	
	Gross irrigated area	1150
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2011)	
	No of Dug wells	9
	No of Piezometers	
9.	HYDROGEOLOGY	
	Major Water bearing formation	Quaternary Alluvium, Granite Gneiss
	(Pre-monsoon Depth to water level during 2011) m bgl.	2.85-8.76
	(Post-monsoon Depth to water level during 2011) m bgl.	1.62-5.55
	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)	20,3, ,4
	Depth range (m)	54 to 202 m
	Discharge(m ³ /hr)	60 to107m ³ /hr
	Storativity (S)	2.75 x10 ⁻³ to 4.75x10 ⁻³
	Transmissivity (m ² /day)	63 to 1265
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 31 st March 2009)- in mcm	
	Annual Replenishable Ground water Resources	42738
	Net Annual Ground Water Draft	5791
	Projected Demand for Domestic and industrial Uses up to 2025	4333
	Stage of Ground Water Development(%)	38.4
13.	AWARENESS AND TRAINING ACTIVITY	NIL
	Mass Awareness Programmes organized	
	Date:	
	Place:	
	No of participant :	
	Training Programmes organized	
	Date	
	Place	
	No of participant	
14.	EFFORT OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING	
	Project completed by CGWB(No & Amount spent)	
	Project under technical guidance of CGWB (Numbers)	
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Blocks notified	Nil
18	MAJOR GROUND WATER PROBLEMS AND ISSUES	

“Ground Water Information Booklet” Banka district, Bihar

1.0 Introduction

1.1 Administration

Banka district was a sub-division of erstwhile Bhagalpur district and was upgraded into a full-fledged district on 21st February, 1991. The district lies between north latitude 24°30'0" to 25° 07'0" and east longitude 86°30'00" to 87°12'00". It covers a parts the degree sheet number 72K, 72O, 72L and 72P of Survey of India. The geographical area of the district is 3019.5 km². It's district Headquarter is in Banka town. The district is bounded in the north by Bhagalpur, in the south by Deoghar, in the east by Godda, in the west by Jamui, in the NW by Munger and in the southeast by Dumka districts. There are 11 development blocks in the district. It's population is 2029339 (2011 census). There are two statutory towns namely Banka and Amarpur. The most populous block is Dhuraiya and the least populous is Phulidumar. The administrative map of the district is given in Figure 1.

1.2 Basin/sub-basin, Drainage

The Banka district lies in south of the river Ganga and constitutes a part of the Ganga River Basin. It falls under Badua –Chandan sub-basin. It has three watershed, namely Badua Nala, Chandan river watershed and the left bank watershed of Burigeria Nala. The major part of the district falls under Chandan river watershed.

Three major rivers/nalas, namely Badua N. (forming the north western boundary), Chandan R. which flows through the central part of the district and the Burigeria N. (forming the eastern boundary of the district) drains the area. All the three rivers/nalas originate from the hilly tracks present in the south of the district and flows from south to north direction. The streams namely Kudar, Orni, Panchkatia are the main tributaries of Chandan, while Lohargara, Karunior, Belharna are the main tributaries of Badua. All the rivers are ephemeral in nature.

1.3 Irrigation Practices

The various major surface water irrigation schemes present in the district are as follows:

1. Chandan Reservoir Irrigation Scheme
2. Kajja Danr Irrigation Scheme
3. Badua Reservoir Project-shambhuganj and Belhar blocks
4. Chandan,Bilasi Irrigation Scheme - Banka
5. Orhni Reservoir Irrigation Project – Banka ,Pullidumer
6. Laxmipur Reservoir Irrigation Project-Bounsi Block

The Chandan reservoir is major irrigation project in the Banka district.Its command area falls in the Banka,Barahat,Rajaun and Dhuraiya block of Banka district. The gross command area is 1.40 m ha. and the surface water irrigation facility is available only to 0.64 m ha in kharif and 7690 ha during rabi (this is inclusive of water directed from small structures like ahar etc.

As per the available statistics of 1994-1995, area irrigated by different sources e.g canals,tubewells,dugwells,other sources etc. constitute 66% of the total cultivated area in the district.canal is the most important source of irrigation in the district. The area irrigated by ground water constitutes 9.44 %(private shallow tubewells 7.9%, other wells 1.5%) of the gross irrigated.

The major landuse categories of the district are given in tabular form(Table.1)

Landuse	Area(in hectare)
Forest	46000
barren and uncultivable land	43000
Land under non-agricultural uses	42000
Permanent pasture and grazing land	2000
cultivable waste other than fallow	8000

source : 1999 directorate of statistics and evaluation,Bihar,Patna)

1.3 Studies/ activities carried out by CGWB

Central Ground Water Board issued a report unpublished report on Hydrogeological condition, Ground Water Resources and development potential

of Bhagalpur district in the year 1985 (unpublished report C.G.W.B) . Quaternary geology and geomorphology mapping of parts of Chandan-Badua sub-basin in undivided Bhagalpur district was carried out by Geological Survey of India in the year 1990.

The district was covered under reappraisal survey during 1995. Under Ground Water Exploration 20 EW and 2 OW were constructed through departmental Rigs by CGWB. One of the EW at Jagatpur, Banka block, had been abandoned. Nine Hydrograph Network Stations (HNS) are being monitored four times in a year as per the ground water regime-monitoring plan of Central Ground Water Board.

2.0 Rainfall and Climate

The climate of the district is characterized by hot summer and a pleasant winter. April to June comprises summer month while November to March makes cold season. The southwest monsoon breaks in the month of June and continues upto the end of September. The average annual rainfall in the district is 1168 mm. The district receives major amount (86%) of precipitation during the monsoon period.

3.0 Geomorphology and Soil

3.1 Geomorphology

The district can be broadly divided into two broad physiographic division viz. alluvial plain in the north and the hilly track in the south. The regional slope from south to north is prominent. The west of the alluvial plain of the river Ganga is bordered by the Munger-Kharagpur hills. The hills of the district are generally moderate in height, denuded and irregularly scattered. Geomorphologically the area is being divided into five distinct units. These units given below are in chronological order from youngest to oldest.

- 1) Diara Surface: It is the youngest morphe-unit of the area comprising of yellow-brown to brownish-grey compact clay. It is the recent flood plain of the major rivers passing through the district.
- 2) Belhar Surface: It is a flat alluvial low land usually free from regular annual flooding, but is prone to water logging in the patches. The

surface overlies the recent flood plain surface .The soil is buff to brown colour and rich in silt, sand or silty clay.

- 3) Sautadih Surface: The surface belongs to the older alluvial upland bordering the pediplains and the hilly area. The soil profile is well developed and characterised by deeply oxidised yellow to brownish red clay with ferruginous concretions.
- 4) Pediplain Surface: The surface borders the northern margin of the district. These rocky units are essentially produced by the erosional process. The surface has developed primarily on the granite gneisses and is characterized by lack of good soil profile and colluvial deposits of weathered material.
- 5) Hilly /Rocky upland: This includes the hilly area of the Chotanagpur plateau, consisting of granite gneiss, quartzites, phyllites and mica schist.

3.2 Soils

Banka district is characterized by a wide variety of soils, which can be broadly grouped into two categories, the alluvial soil and hilly soil. The alluvial soil derived partly from the older alluvium deposit and partly from the newer flood plain deposit is characterized by light grey to dark grey colour and fine texture. The hilly soil derived from the weathered product of rocks is coarse grained, ferruginous, low in nitrogen ,medium to high potash and acidic in nature.

4.0 Ground Water Scenario

4.1 Hydrogeology

The Banka district can be sub-divided broadly into two hydrogeological units.(figure-2)

- 1) Alluvial Formation: It occupies the northern part of the district.The Quaternary alluvial deposits consisting of sand ,silt and clay forms a good repository of the ground water. The ground water occurs in the porous material under both unconfined and semi-confined to confined conditions depending on the disposition of aquifers.

- 2) Fissured Formation: The fissured formation constitutes the Chotanagpur Granite Gneissic Complex and meta sedimentaries. Ground water occurs in these rocks under confined to semi-confined conditions. The secondary porosity e.g. fractures, joints and fault planes acts as aquifer and controls the storage and movement of ground water.

Ground water in the alluvial track of the district

The thickness of Quaternary Alluvial deposit generally ranges from 15m to 100m in the northern part of the district. The maximum depth to bedrock is at Raipura which is 99m. The sandy layers in the alluvial terrain form the main repository of ground water in the northern part of the district. The thickness of alluvial deposit increases from south to north. Ground water usually occurs under both unconfined conditions in aquifer disposed at shallower depth and under semi-confined to confined condition at deeper depths. The thickness of granular zone ranges between 18-25 m at a depth ranging between 50 and 99 m below ground level. The yield ranges between 60m³/hr to 124 m³/hr for a drawdown of 21 m and 8.00 m respectively. The available data indicate that in Shambhuganj block there exist a number of granular zones in shallow and deeper levels. In this block there is a wide scope of ground water development through shallow tubewells upto 50m depth. The deep tube wells up to 100m depth may give a discharge of 75-100 m³/hr. The exploratory data indicate that there is a wide variation of the transmissivity value which varies from 63.7 m²/day at Khirri to 1265 m²/day at Rudpai. The transmissivity is found to be increasing towards northwestern part of the district, where the thickness of the aquifer is also more. The storage co-efficient value as estimated has been 2.75×10^{-3} at Warshabad, which shows that aquifer are under semi-confined condition.

Ground water in the hard rock formation

As the southern part of the district is underlain by Precambrian formations, the movement, occurrence and distribution of the ground water is primarily controlled

by nature and distribution of joints, fissures and other structural zones of weakness. At places the granites and meta-sedimentaries are weathered and extensively jointed. Ground water occurs in this weathered formation in unconfined condition, Whereas the deeper fracture within the hard rocks also form a very good repository of ground water.

Depth to Ground Water level

Depth to ground water level maps for pre-monsoon (Figure-3) and post-monsoons (Figure-4) 2011 have been prepared. A perusal of the depth to water level map of pre-and post-monsoon 2011 period indicates that water level ranges between 2.85 to 8.76 mbgl and 1.62 to 5.55 m bgl, respectively.

4.2 Ground Water Resources:

Annually replenishable dynamic ground water resource of the unconfined aquifer has been estimated as on 31st march 2009 for all the blocks following GEC-1997 methodology. The net annual replenishable ground water resource of the district is 42738 ham. The gross draft for all uses (irrigation, domestic and industrial water supply) as on 31st March 2009 worked out to be 5791 ham, and the existing gross ground water draft for irrigation works out to be 12774 ham. The allocation for domestic and industrial requirement up to next 2025 years works out to be 4333 ham. The stage of ground water development of the district is 38.4% which indicate that though all the blocks of the district falls under safe category and are under developed in terms of utilisation of ground water resources. This gives ample scope for development of ground water for irrigation and other uses. Maximum ground water development is in Amarpur block (52.1%), where as the minimum in Dhuraiya block (28.9%). Details of ground water resources of all blocks are presented in Table 2.

Table- 2 Assessment of Dynamic Ground Water Resources of the Bihar state
Banka 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 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	Amarpur	4172	1767	404	2172	616	1789	52.1
2	Banka	3507	1151	442	1593	447	1908	45.4
3	Barahat	2165	765	211	976	317	1082	45.1
4	Bausi	2558	573	255	828	384	1601	32.4
5	Belhar	2494	966	222	1188	335	1193	47.7
6	Chandan	3748	1122	218	1340	329	2298	35.7
7	Dhuraiya	6262	1489	322	1811	485	4288	28.9
8	Katoria	6640	1715	253	1968	382	4544	29.6
9	Phulidumar	1554	389	163	552	246	920	35.5
10	Rajun	4990	1355	281	1636	423	3212	32.8
11	Shambhuganj	4648	1483	245	1728	369	2796	37.2
	Total	42738	12774	3017	15791	4333	25630	38.4

4.2 Chemical quality of ground water:

The chemical analysis of ground water samples of the HNS location in the district for May 2006 indicates that the water is potable and can be used for industrial and irrigation purposes. The ground water of the district is basic in nature. On the basis of chemical analysis data the major cation and anion in the district are Ca and (HCO₃) respectively. The range of concentration of major constituents in ground water is given below (Table-3):

Chemical Parameters	Range
1. pH	7.05 – 8.44
2. Specific conductance	390 – 1030 micromhos/cm at 25oC
3. Calcium	16 – 100 milligram/litre
4. Magnesium	4.9 - 24 milligram/litre
5. Bicarbonate	128 -226 milligram/litre
6. Chloride	28 - 163 milligram/litre
7. Total hardness as CaCo3	70 -350 milligram/litre
8. Na	18 - 115 milligram/litre
9. K	0.4 – 43 milligram/litre

4.3 Status of Ground Water Development- Block wise

In Banka district the stage of ground water development is 38.4%(Figure-5). The low utilization of ground water for irrigation in the district can be visualized. The structures like dug well, private shallow tube well, deep tube well are the main source of ground water abstraction structures. Till the year 1995 state tubewell existed in the district. However, eight exploratory wells constructed in the alluvial tracks of the district by CGWB ,opened new avenue for ground water utilization. Surface water irrigation plays important role in providing assured irrigation in the district.

Only the towns have drinking water supply. The rural area depends on dug well, private shallow tubewells, river hand pumps and ponds for drinking water purposes.

5.0 Ground Water Management Strategy

5.1 Ground Water Development

A perusal of Table 2 indicates that most of the blocks have low ground water development except Amarpur, Banka, Belhar & Barahat blocks which have the stage of ground water more than 40%. As per the available record the present utilization of ground water for irrigation is low as compared to the surface water. Surface water canal is the most important source of irrigation. In the pediplain the large diameter dug wells should be preferred to tubewell. The tube well site should be scientifically located after hydrogeological and geophysical studies. A shallow tube well can yield upto 25m³/hr discharge.

In the alluvial tracks shallow tubewell upto a depth of 50m may yield 50 m³/hr by tapping the granular zones thickness. A deep tube well of 100m depth may yield upto 75-100 m³/hr (Table 4).

Table 4. Feasibility of Ground Water Structures in Banka district.

Type of Structure	Diameter(m)	Depth range(m)	Expected thickness of aquifer /fracture	Expected yield range(m ³ /hr)	Command area(Ha)	Hydrogeological setting
Dug well	3	10-15	2-3	5	0.5	Alluvial plain/Granite gneiss
Shallow Tube well	100	40-50	10-15	40-50	5	Alluvial Plain/ Granite gneiss
Deep tube well	150	75-100	15-25	75-100	10-12	Alluvial Plain
Shallow bore well	125	40-50	5-10	15	15	Pediplain/Granite gneiss
Deep bore well	150	100-125	10-20	25-30	5	Granite gneiss

5.2 Water Conservation and Artificial Recharge

As the southern portion of the district is dominantly hilly and is surrounded by gently sloping pediment surfaces, there is ample scope to conserve water by water conservation structures like contour bunds, tanks and ponds. Construction of any water conservation structure should be done after taking into consideration the local topography, slope, depth to ground water level and public participation. By these conservation structure will help recharge ground water.

6.0 Ground water related issue and problems:

Water-Logging and Flooding: The alluvial plain of the district is by and large free from any major flood or water logging problems. But due to excessive load of sediments in the streams during the peak monsoon, flash flood occurs in the district. Most affected blocks are Banka, Rajaun and Amarpur.

Low ground water development: The overall stage of ground water development in the district 32.7% which is very low and the contribution of ground water towards irrigation is minimal.

7.0 Mass Awareness and Training Activity:

7.1 Mass Awareness Programme:

No mass awareness and training activities have been carried out in this district.

8.0 Area notified by CGWA/SGWA

All blocks of Banka district are under safe category for ground water development point of view. So far no block has been notified by either Central Ground Water Board or by State Ground Water Authorities.

9.0 Recommendation

- (1) Keeping in view the fact that huge volumes of ground water exist, a ground water development plan may be taken up. In the hard rock gneissic terrain large diameter dug wells are preferred to borewell. However, with proper scientific approach shallow borewell of 40-50 m depth and deep bore well of 100-125 m depth are feasible in gneissic rocks. In alluvial area shallow tubewell upto 50m depth is preferred as compared to dugwell. The shallow tubewell can yield 50m³/hr, while deep deep tubewell upto a depth of 100 m (specially in Shambhuganj block) can yield upto 100 m³/hr.
- (2) In Chandan Badua command area conjunctive use of surface and ground water may be practiced. In Shambhuganj block the augmentation of canals by ground water resource can be done and a portion of surface water can be diverted to adjacent areas where ground is scarce.
- (3) Artificial recharge in the hilly and pedimental landscape area should be taken up by consideration the post monsoon ground water level. As it can be observed from the post monsoon water table map ,the southern area of blocks Chandan and Katoria blocks are suitable for articial recharge.
- (4) Flooding in the district can be minimized by constructing a series of check dams and gully head plugs.

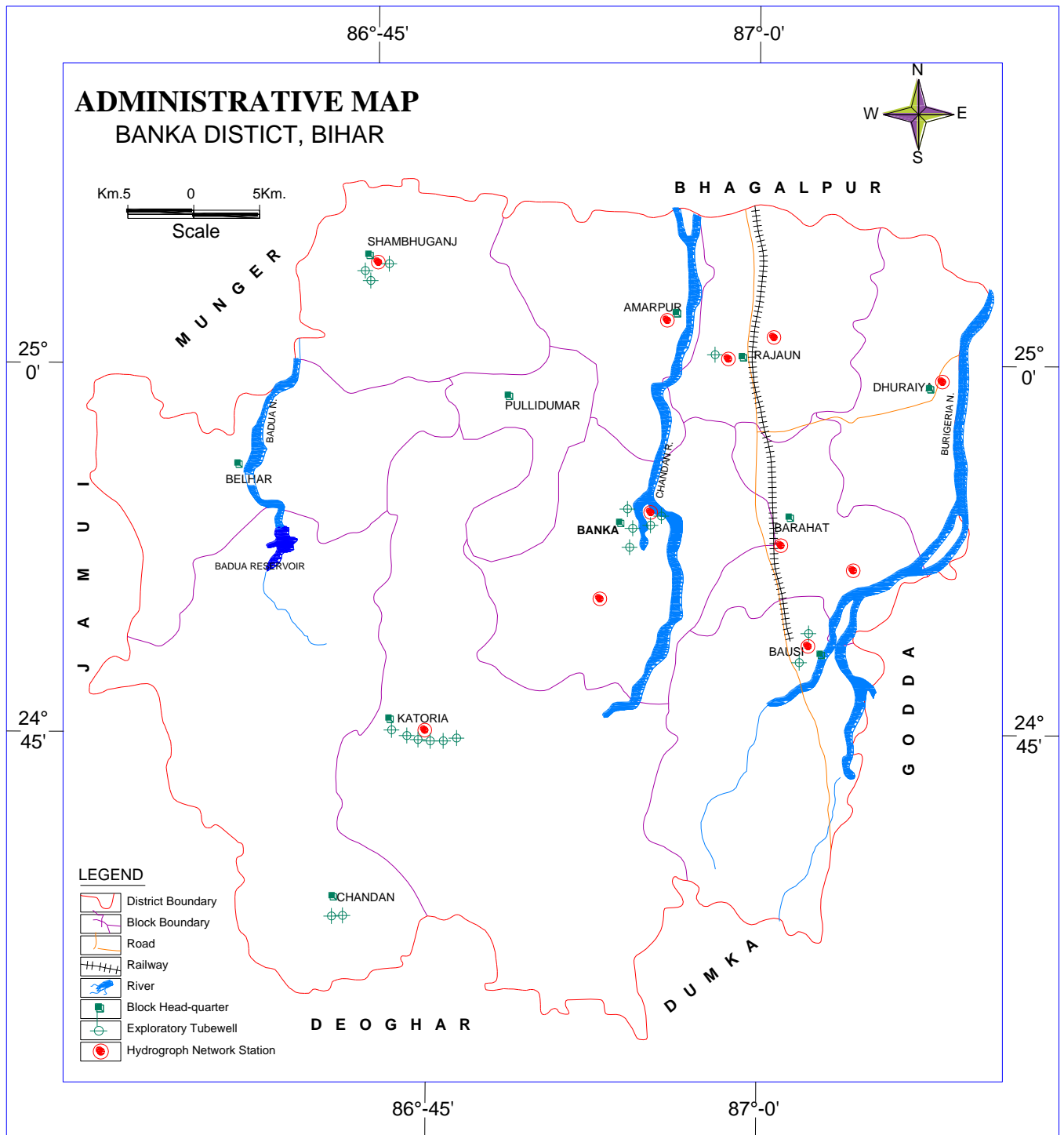


FIGURE 1. ADMINISTRATIVE MAP OF BANKA DISTRICT, BIHAR

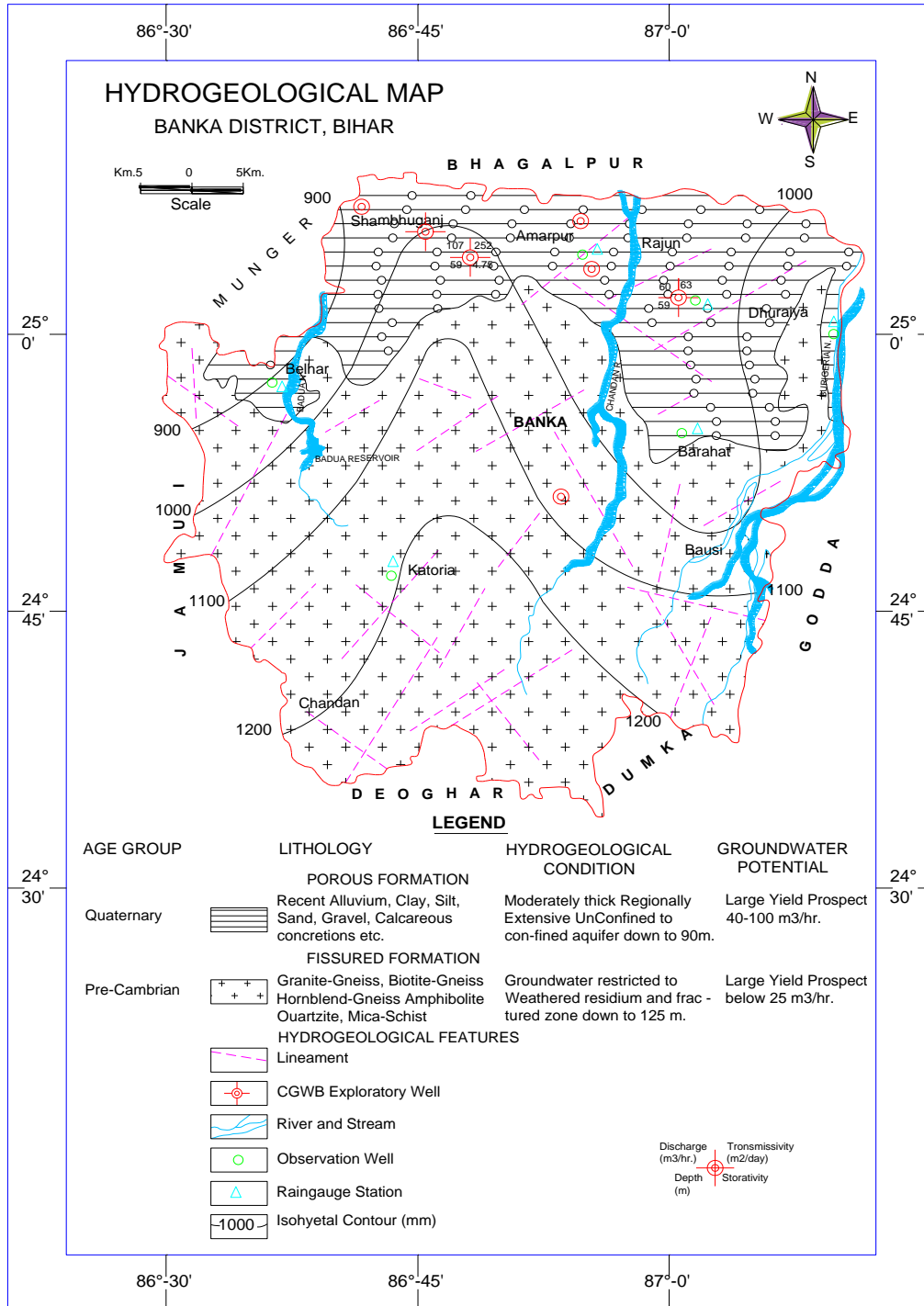


FIGURE 2. HYDROGEOLOGICAL MAP OF BANKA DISTRICT, BIHAR

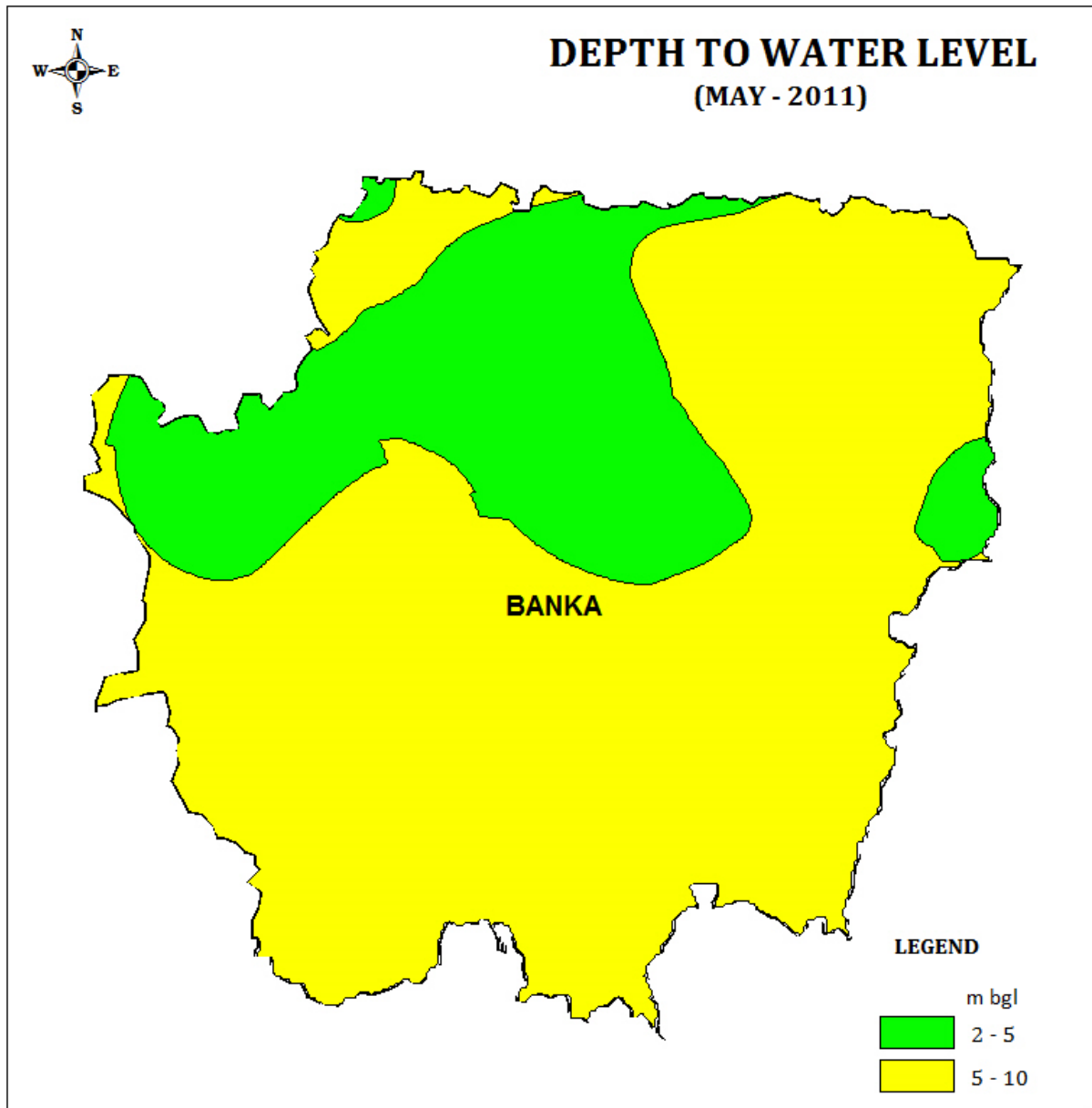


Fig. 3 Depth to water level map of pre-monsoon 2011.

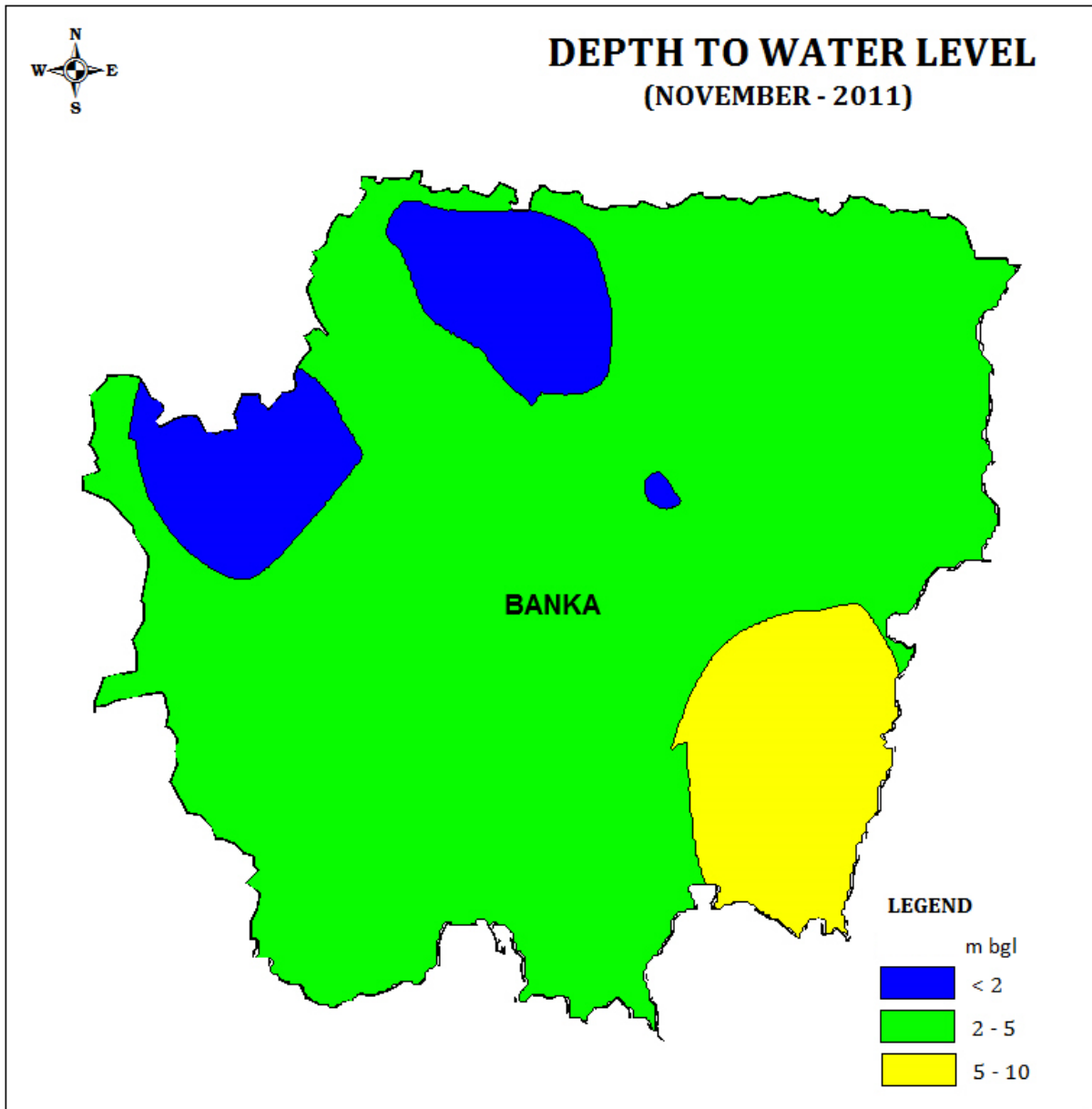


Fig. 4 Depth to water level map of post-monsoon 2011

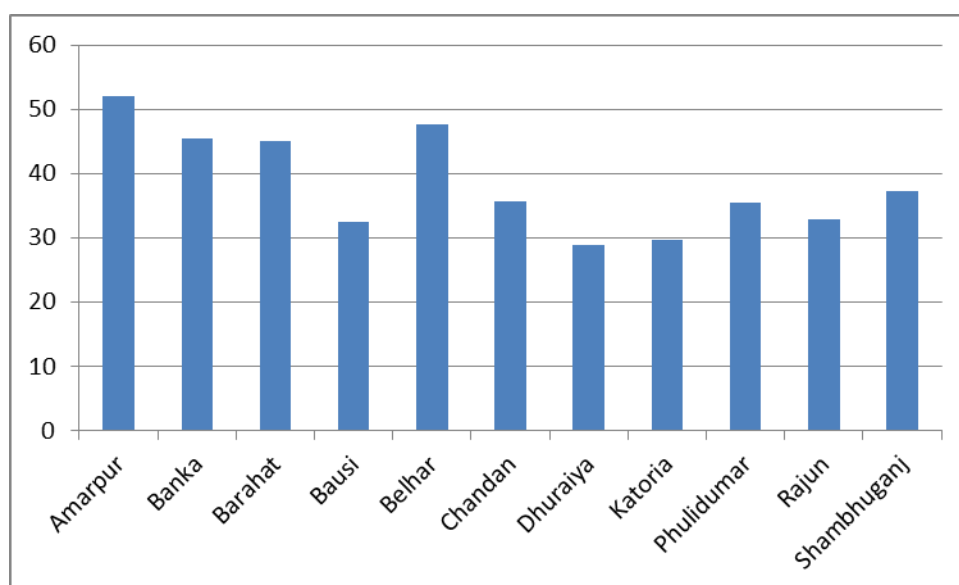


Fig. 5 Block-wise stage of ground water development of the district