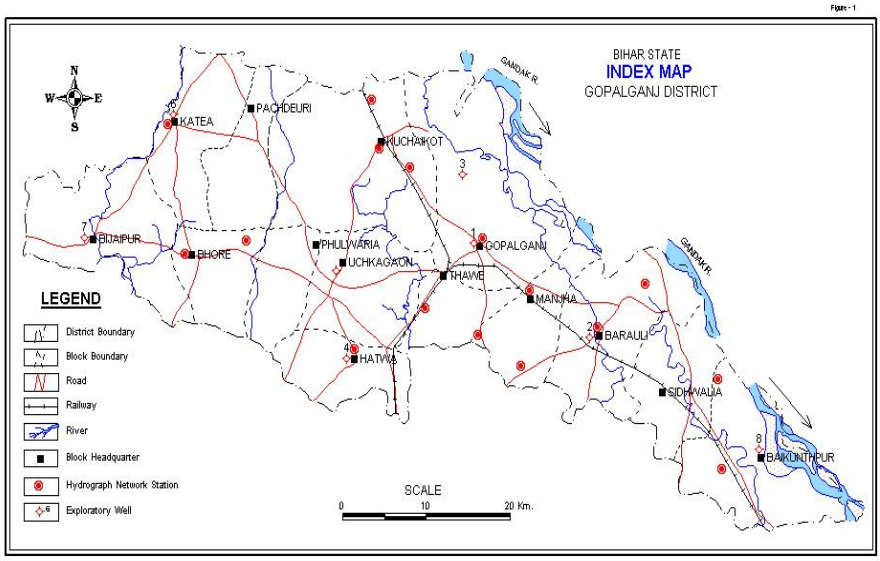
भूजल सूचना पुस्तिका

गोपालगंज जिला, बिहार

Ground Water Information Booklet

Gopalganj 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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GOPALGANJ DISTRICT AT A GLANCE

Sl. No.	ITEMS	Statistics	
1.	GENERAL INFORMATION		
	i) Geographical area (SqKm)		2033
	Administrative Division		
	i) Number of Tehsil/ Block		14
	ii) Number of Punchyat/Villages		1564
	iii) Population (As on 2011 Census)		2558037
	iv) Average Annual Rainfall (mm)		1170
2.	GEOMORPHOLOGY		
	Major physiographic unit :		
	Major Drainages:	Gandak	
3.	LAND USE (Sq.Km)		
	a) Forest area:		Nil
	b) Net area sown:		1545.5
4.	MAJOR SOIL TYPE		
5.	AREA UNDER PRINCIPAL CROPS		
6.	IRRIGATION BY DIFFERENT SOURCES (Areas sq.km and number of structures)	Area	No.
	Dugwell	-	4580
	Tubewell/Borewell	644.10	21299
	Tank/ponds	Nil	-
	Canals	319.72	-
	Other sources	1.89	72
	Net irrigated area	970.71	
	Gross irrigated area	1094.35	
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2011)		
	No of Dug wells	11	
	No of Piezometers	Nil	
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Quaternary Alluvium	
9.	HYDROGEOLOGY		
	Major Water bearing formation		
	(Pre-monsoon Depth to water level during 2011) m bgl.	2.72 to 6.32	
	(Post-monsoon Depth to water level during 2011) m bgl.	1.41 to 3.63	
	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)		8 + 10
	Depth range (m)		200 to 205
	Discharge (litres per second)		**20 to 50**
	Storativity (S)	**2.3×10^{-3}**	**to 4.3×10^{-4}**
	Transmissivity (m^2/day)		**1284 to 2392**
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 (2009)- in mcm		
	Annual Replenishable Ground water Resources		603.56
	Net Annual Ground Water Draft		359.92
	Projected Demand for Domestic and industrial Uses up to 2025		59.93
	Stage of Ground Water Development		59.63
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 ARTIFICIAL 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

Gopalganj District, Bihar State

1.0 INTRODUCTION

1.1 Administration

Gopalganj district is situated in the northwest part of the state. It lies between N-latitude 26012' & 26039' and E longitude between 83054' & 84055'. It covers parts of Survey of India toposheet Nos. 72 A/2, B/3, O/6, B/7, B/10, B/11 & B/25. This district comes under Indo-Gangetic plain covering plain and Gandak-Ghaghra sub-basin. There are 14 development blocks with two sub-basins. It is bounded by Uttar Pradesh on the north and west whereas by Gandak river in the east and by Siwan district on south.

The district Gopalganj is having an area of 2033 sq.km with 14 blocks and 1564 villages. As per 2011 census the total population in the district is 2558037 with Rural 2396270 and Urban 161767.

1.2 Basin/Sub-basin, Drainage

The district is mainly drained by Gandak river that has taken the present course ,which forms the eastern and north eastern boundary of the district. The Gandak river flows in a south easterly direction with an average gradient of 0.28 m/km. The river brings a lot of silt, which is deposited in the river bed resulting in oscillation of course.

Apart from this main rivers there are numerous ephemeral streams flowing in the district namely Jharbi, Dahe, Khanua, Ghoghli, Kedanjot, Sona etc. They all emerge near Gandak embankment which are locally known as Chaurs and Tal. In course of time these beds get silted and their course start shifting. During the process of shifting of course there streams leave behind abandoned channels and a number of marques locally known as Chaus. These Chaus are also responsible for water logging in the area by spreading their span with the onset of monsoon and become localize during summer. Most of the ephemeral streams have their flow direction in north south.

1.3 Irrigation Practices

The rapid growth of population demands for greater production in bringing more and more land under cultivation. The socio-cultural and economic political factors play

siguticant role over land use in soft rural and urban area in the district. The blockwise details of land utilization reveals that 74% of the total area in net shown.

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 Gopalganj district, Bihar" was issued in the year 1992. A total of 8 exploratory wells has been drilled in the district. Water levels of 16 hydrograph stations representing phreatic aquifer 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 2004.

2.0 RAINFALLS AND CLIMATE

In the area monsoon sets in somewhere in June and lasts upto September. The average annual rainfall in Gopalganj district is about 1218 mm. Most of the rainfall receives from South West monsoon. Data reveals that there is a large variation in the ranfall over year to year. The behaviour of isohyte is given in Plate.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

Flat alluvial formations of considerable thickness is very common in the entire district. The entire flat terrain has been divided into two main categories.

a) **Alluvial Low Tracts**: - They are most commonly found in the immediate vicinity of river Gandak which is subjected to periodical submergence by flood water.

Diara Land: - They are nothing but heap and sands, brought by rivers during flood and usually found in the bed of the river Gandak. There is a gradual slope from the north western to south eastern direction. The general slope varies between 70.69 mt MSL to 57.09 mabMSL. In general the surface gradient in about 0-11 m/km in the area.

3.2 Soil Characteristics

As per the U.S. Survey Staff (1975) the soil of the area is broadly divided into three groups based upon the diffluent conditions of pedogeny, climate and texture.

a) Entisols – These are younger alluvial soil, fringes near the bank of Gandak and the eastern bank of Ghaghra in the western part of the district. The entisols are generally a light, friable, loam with higher proportion of sand and silt. The maximum percent of clay is found to be upto 35%. They are often associated with calcareous nodules. The higher content of sand keeps the soil, except in the river bed, fairly drained and makes it suitable for autumn and rabi crops which do not need much water. These soils are most suitable for cultivation of high yielding crops like sugar cane and wheat.

b) Inceptisols - There are locally known as Bangar and there calcareous alluvial soils occur mostly in the central part of the district. This forms the typical paddy land of Bihar. The clay and silt % ranges between 30-45%.

Alfisols – These soils occur in patches around eastern part of the district. These are farely matured soils subject to continuous leaching operation, leading to formation of calcareous nodules and ferruginous clay pans. Texturally there are well-drained reddish yellow silty sandy and clayey loams.

4.0 Ground Water

4.1 Hydrogeology

The district forms a part of the vast alluvial terrain of Gandak and Ghaghra sub-basins forming a part of Indo-Gangetic alluvium consisting of a thick pile of unconsolidated quaternary sediments. They are recent to sub-recent deposits underlain by erosional basement of Vindhyan formation of pre-cambrian age. The thickness of alluvium is still not yet confirmed through boreholes. These quaternary sediments consist of sequences of finer clastics like clay and silts with various grades of sand and gravel associated with Kankar. The lithological characteristics are mainly governed by the depositional environments namely distance from the provenance, agencies of deposition and the medium of transport. Marked lateral and vertical variations is texture and composition of sediments support these propositions.

The Gangetic alluvial deposits can be sub-divided into two types viz. newer alluvium and older alluvium. The older alluvium of Pleistocence age in the area is rather dark in colour, occupies the higher ground and generally rich in kankar which are concretion of nodules of impure calcium carbonate ranging in size from small grains to

loose lumps whereas the newer alluvium of recent age occupying the lower grounds constitute a thick sequence of clay, silt and sand with occasional kankar.

Depth to water level in pre-monsoon 2011 and post-monsoon 2011 is ranges between 2.72 to 6.32 and 1.41 to 3.63 m bgl, respectively.

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 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 Gopalganj 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. The detail is being given in annexure. Recharge has been calculated by water level fluctuation method. The specific yield of the alluvium in the district has been assumed between 12 to 18%.

A 20% gross annual draft is presumed to be recharging the ground water bodies. A review of the annexure reveals that Kuchaikot block is having the highest ground water potential whereas Thawe has the lowest.

	In MCM
Total Ground Water Resource	603.56
Total ground Water Resource for irrigation	318.89
Gross annual Ground water Draft	359.92
Allocation for Domestic and Industrial Requirement supply upto year 2025	59.93
Stage of ground water development	59.63%

As per estimation of blockwise draft data the level of development is maximum in Bijaipur block (76.6%) whereas in the Gopalganj block (37.5%) development is the minimum.

4.3 Chemical Quality of Ground Water

The quality of groundwater has gained importance with increasing population and industrialization. These factors spoil the environment of which groundwater is an important part.

Ground water is uncontaminated water not containing suspended particles or bacteria as it occurs below the ground and is in accessible in a sense. It is generally clear and odourless. But ground water usually contains dissolved mineral ions. The type and concentration of ions present determines the usefulness of ground water for various purposes. Hence, hydrochemistry is an important aspect and the chemical constituents need to be assessed for various uses.

Ground water samples from HNS were taken into consideration. These wells are located in Gopalganj district and represent the same hydrogeological and aquifer system (in this case phreatic). The analytical results are given in Table below.

Table: Range of Chemical Constituents, Gopalganj district

Constituent	Range (in mg/l)	Drinking Water Standards (BIS : 10500 : 1990)
		Desirable limit/permissible limit (in mg/litre)
EC	370-1270	500/2000 TDS
PH	7-7.5	6.5-8.5 / 6.5-8.5
HCO_3	122-415	
Cl	18-270	250/1000
Ca	12-66	75/200
Mg	19-90	30/100
Na	25-138	-
TH	120-535	300/600
K	3-16	-
As		.05 mg/l (Karanth)

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. Ground Water Management Strategy

5.1 Ground Water Development

The development of ground water resource of Gopalganj district shows that at present the stage of development is about 60 %. At present all the blocks come under safe category.

The district is an agricultural district. So, in areas where ground water development is high, such development can be done phase wise with a cautions and judicious outlook.

Present Ground Water Development

It has been observed that nearly 60% of the net irrigated area of the district is served by ground water structures based upon minor irrigation system. The canal irrigation is still far away from satisfaction and nearly 15% of the area is irrigated by canal. The draw back with canal irrigation system is that the canal water is still unavailable at tail end area and in upper reaches it is not relieved in time. The maintenance of the canal system is also not satisfactory.

In the entire district, still most of the villages depend upon wells, tanks, ponds, hand pumps/tubewells, rivers and other sources for drinking water supply still only a limited towns / villages are promoted by water supply.

To meet the requirement of ground water in Gopalganj district, many tubewells were completed by E.T.O. and State Govt. agencies. Later on by CGWB; at eight sites exploratory tube wells were constructed. The heavy-duty tube wells were constructed by tapping the granular zones of 90 m to 100 m

with a thickness of about 20mt to 50 m. whereas in the state shallow tubewells granular zones between 50 to 90 m has been tapped. The discharge of heavy-duty tubewell ranges between 134 to 250 m^3/hr whereas for shallow tubewell it varies between 20 to 50 m^3/hr. In this regard a number of dug wells were also constructed with a diameter between 1.10

to 2.40 m and the discharge of well depends generally on the thickness and nature of aquifer tapped up to 14.00 m.

Future Ground Water Development Possibility

As per available present ground water utilisation it is observed that there is still a good chance to enhance the ground water development. So, by using different types of structures; based upon high yielding and low yielding discharge tubewells the demand of drinking and irrigation requirement can be met as per the demand of user agencies.

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 Thawe and Vijayeepur blocks where stage of ground water development is high. As entire district is covered by the 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

The district is underlain by potential unconsolidated aquifer system amd as such there are 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 any mass awareness/training programme has been organised in the district

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

All blocks of Gopalganj district are under safe category for ground water development point of view. No blocks has been notified by CGBA/SGWA.

9.0 RECOMMENDATIONS

1. As the district is an agricultural based district and its all socio-economic fabric is directly related with agriculture, so the main emphasis is to be given for development of ground water especially in the care of irrigation.

2. In view of inadequate surface water irrigation the gap between the demand and supply can be filled by integrated use of surface water resource available in the district.
3. The special attention should be given towards the structures already created but which have become defunct. These structures unit be rehabilitated so that it creates a confidence among the beneficiaries and it can help to boost the overall productivity through multiple cropping pattern.

4. The behaviour of water table should be watched constantly. In this contest, the rise and fall in water level should be studies and monitored so that the additional irrigation structures can be planned accordingly.
5. To mitigate the water logging problem in the district the conjunctive use of surface water and ground water should be taken up in phase manner. The lining of the canals in strongly recommended.
6. To keep in view the efficiency and proper discharge, minimum standard for well spacing should be maintained. For this a minimum distance for shallow wells should be kept 150 mt whereas for deep tubewells it should be 600 mt. Selection of pumping system should be such that they can yield in the optimum efficiency.
7. To minimise the cost the brass stainer should be replaced by low cost materials. In the district there are 2 to 3 types of aquifers, so just to give benefit the small and marginal farmers it is always suggested that the shallower aquifers should be left far them.
8. To increase the agricultural productivity, scope it environmental hazards like flooding etc can be reduced.

DISTRICT : GOPALGANJ

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	17
1	**GOPAL-GANJ/ Gopalganj sadar** $26^0$28'50" $84^0$26'45"	201	150	040.00-049.00 065.00-083.00 097.00-104.00 108.00-114.00 114.50-147.50	3.87	194.64	9.68	20.1	1127	$4.80X10^{-4}$	2"/6"	ALLUVIUM	POTABLE	1990	F.O.C.	
	OW	152.7														
2	**BARAULI/ BARAULI/** $26^0$25'00" $84^0$37'40"	200	150	052.00-064.00 085.00-097.00 099.00-105.00 111.00-117.00 123.00-135.00 141.00-147.00	3.05	200.3	5.61	35.7	2392	$2.40X10^{-3}$	12"/6"	-do-	-do-	1990	F.O.C.	
	OW	156.1														
3	**YADAVPUR**	200	110	031.00-043.00	4.17	211.44	5.77	36.64	1836	$4.30X10^{-4}$	12"/6"	-do-	-do-	1991	F.O.C.	

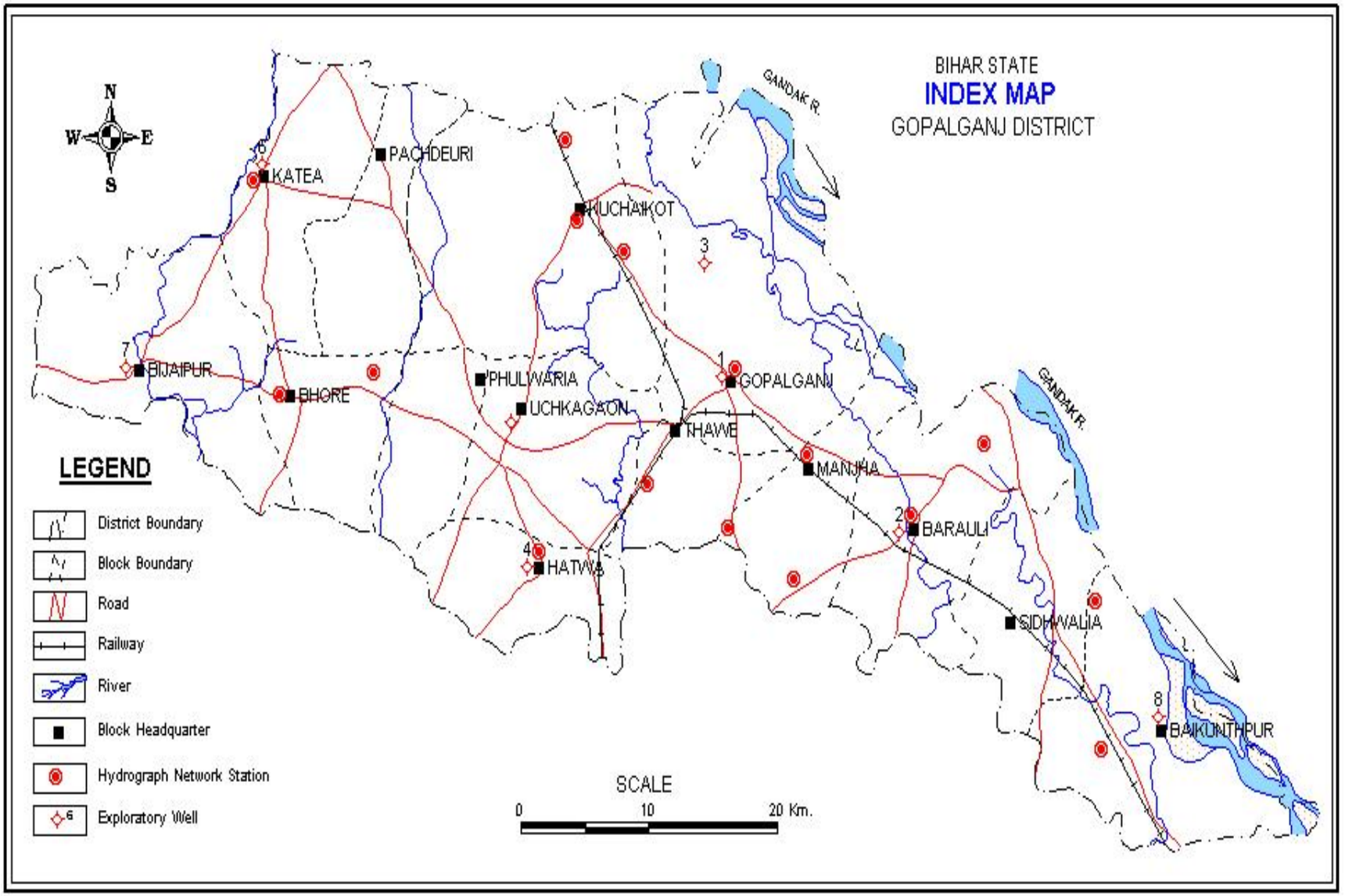
	Gopalganj			046.00-058.00											
	Sadar			104.00-107.00											
	$26^0$33'65"														
	$84^0$31'50"														
	OW	113.65													
4	**HATHUA/**	201	122	086.00-098.00	4.79	208.2	11.21	18.57	1284.52	$1.25X10^{-4}$	12"/6"	-do-	-do-	1991	F.O.C.
	Hathua			107.00-119.00											
	$26^0$22'20"														
	$84^0$19'10"														
	OW	125.63													
5	**UCHKA-GAON/ Uchkagaon**	200	150	041.00-047.00	1.08	208.7	9.7	21.68	1899	$4.3X10^{-4}$	12"/6"	-do-	-do-	1991	F.O.C.
				061.00-067.00											
				098.00-104.00											
	$26^0$27'15"			110.00-122.00											
	$84^0$17'25"			145.00-148.00											
	OW	153													

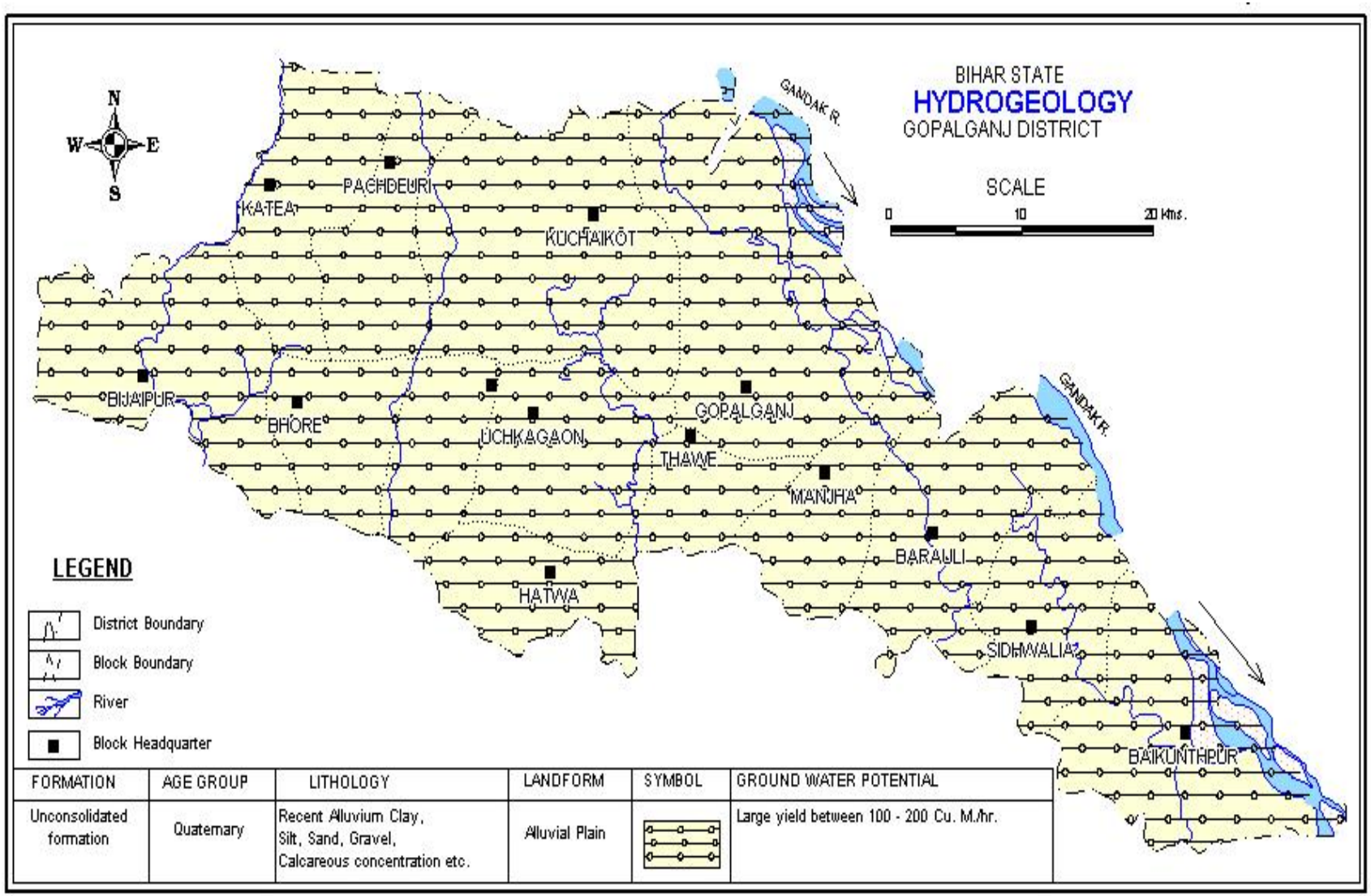
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
6	**KATEA/ Katea** $26^0$36'00" $84^0$07'40"	202	135	056.00-062.00 072.00-078.00 084.00-090.00 102.00-108.00 120.00-132.00	2.36	215	9.91	21.69	2210	$3.01X10^{-4}$	12"/6"	-do-	-do-	1991	F.O.C.	
	OW	140.77														
7	**BIJAIPUR** $26^0$30'30" $84^0$00'45"	200	140	048.00-060.00 072.00-084.00 090.00-096.00 132.00-138.00	3.84	200.3	8.62	23.2	1472	$3.3X10^{-3}$	12"/6"	-do-	-do-	1991	F.O.C.	
	OW1	144.2														
	OW2	31.4														
8	**BAIKUNTH-PUR/ Baikunthpur** $26^0$00'26' $84^0$44'54"	205	141	065.00-074.00 086.00-092.00 099.00-105.00 117.00-123.00 126.00-138.00	3.02	84.2	18.9	4.45	1788	$2.30x10^{-3}$	12"/6"	-do-	-do-	1992	F.O.C.	
	OW1	144.3														
	OW2	16.2														

Assessment of Dynamic Ground Water Resources of the Bihar state
Gopalganj 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	Baikunthpur	5456	2791	309	3100	475	2190	56.8
2	Barauli	4789	2393	532	2925	601	1795	61.1
3	Bijaipur	4266	3067	202	3268	310	889	76.6
4	Bhore	4841	3348	259	3608	399	1094	74.5
5	Gopalganj	5379	1688	330	2018	533	3158	37.5
6	Hathua	4493	2936	328	3264	504	1053	72.6
7	Kateyan	4075	1902	281	2183	459	1714	53.6
8	Kuchaikot	8504	3960	484	4444	744	3800	52.3
9	Manjha	4188	2295	300	2595	461	1432	62.0
10	Phulwaria	3077	1626	191	1817	294	1157	59.0
11	Panchdeori	2784	1429	146	1575	224	1131	56.6
12	Sidhwalia	2785	996	199	1195	305	1484	42.9
13	Thawe	1699	959	169	1127	259	481	66.3
14	Uchkagaon	4020	2501	372	2873	425	1094	71.5
Total		**60356**	**31889**	**4102**	**35992**	5993	**22474**	59.63


BIHAR STATE
INDEX MAP
GOPALGANJ DISTRICT
N
W
E
S
GANDAK R.
GANDAK R.
KATEA
PACHDEURI
KUCHAIKOT
BIJAIPUR
BHORE
PHULWARIA
UCHKAGAON
THAWE
GOPALGANJ
MANJHA
BARAULI
HATWA
SIDHWALIA
BAIKUNTHPUR
LEGEND
District Boundary
Block Boundary
Road
Railway
River
Block Headquarter
Hydrograph Network Station
Exploratory Well
SCALE
0
10
20 Km.



FORMATION	AGE GROUP	LITHOLOGY	LANDFORM	SYMBOL	GROUND WATER POTENTIAL
Unconsolidated formation	Quaternary	Recent Alluvium Clay, Silt, Sand, Gravel, Calcareous concentration etc.	Alluvial Plain		Large yield between 100 - 200 Cu. M./hr.

Fig. Hydrogeological Map of the study area.

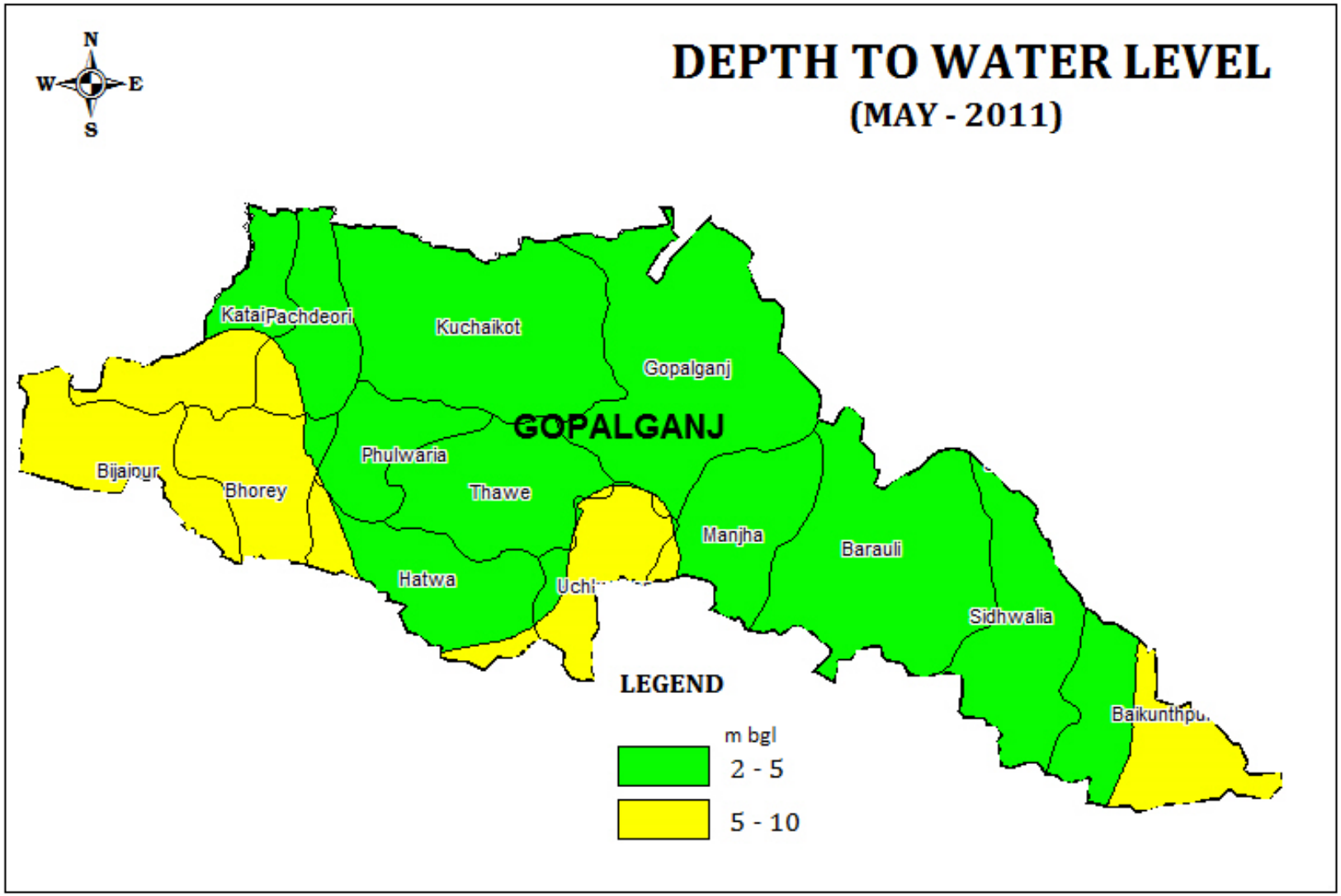


Fig. Depth to water level map of pre-monsoon 2011.

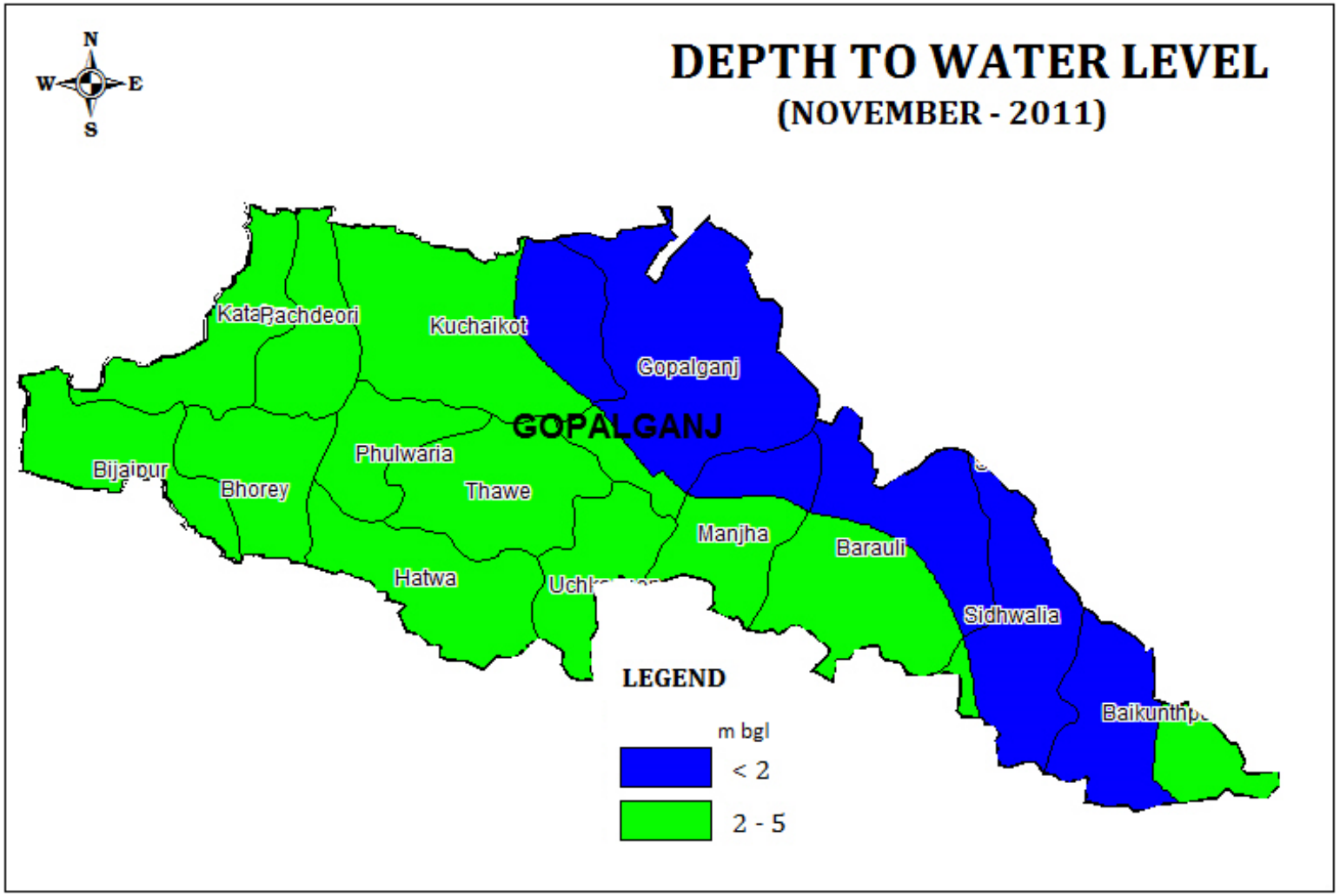


Fig. Depth to water level map of post-monsoon 2011.

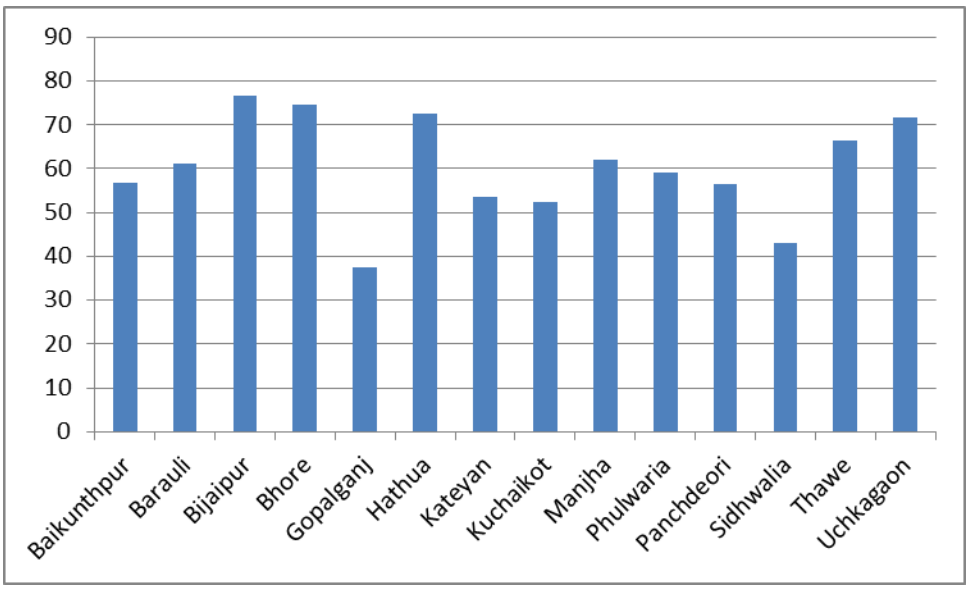


Fig. Blockwise stage of ground water development