

# **GROUND WATER BROCHURE BALRAMPUR DISTRICT, U.P.**

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## BALRAMPUR DISTRICT- AT A GLANCE

1.	GENERAL INFORMATION		
	Geographical Area (Sq km)	:	3349
	Administrative Divisions (As on 2010-11)	:	
	Number of Tehsils/Blocks	:	03/09
	Number of Panchayat/Villages	:	667/1021
	Population (As on 2011 Census)	:	2149066
	Average Annual Rainfall (mm)	:	1152
2.	GEOMORPHOLOGY		
	Major physiographic units	:	Upland plains, Gently undulating slope towards south. Older & Younger alluvium
	Major Drainages	:	Rapti
3.	LAND USE (Sq Km) ( 2010 -11 )		
	Forest area	:	587.97
	Net area sown	:	2127.18
	Gross area sown	:	3112.87
4.	MAJOR SOIL TYPES		
		:	Clay, sand and loam
5.	Area under principal crops (Sq Km) (As on 2010 -11)	:	2291.09 Rice,wheat,masur,pulse
6.	IRRIGATION BY DIFFERENT SOURCES (2010-11) (Number of structures/Area (Sq Km)		
	Dugwells	:	122 /8.73
	Government Tube wells & Pumpsets (Electric/ Diesel)	:	51047/629.29
	Tanks/ponds	:	---/35.22
	Canals	:	636 Km/36.52
	Other sources	:	NA/23.06
	Net Irrigated area	:	709.76
	Gross irrigated area	:	1161.93
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2012)		
	No of Dug Wells	:	14
	No of Piezometers	:	02
8.	PREDOMINANT GEOLOGICAL FORMATIONS		
		:	Alluvium
9.	HYDROGEOLOGY		
	Major Water bearing formation	:	Sand and Gravel
	Pre-monsoon Depth to water level (m. bgl)(May 2012)	:	3.15 (Gaura) – 8.05 (Bankatwa)
	Post-monsoon Depth to water level (m. bgl)(Nov 2012)	:	1.85(Sonpur) -9.18 (Bankatwa)

	Long term water level trend in 10 yrs(2003-2012) in m/yr	:	Pre-monsoon: Rise 0.01 – 0.04 Fall 0.12 Post- Monsoon Rise 0.06-0.29 Fall 0.003 – 0.15
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-3-2013)		
	No of wells drilled (EW, PZ, SH)	:	EW-17, PZ-02
	Depth Range of EW's (mbgl)	:	270.55 (Belbharia) – 751.00 (Devipatan)
	Discharge (lps)	:	2.33 (Lohati) – 53.92 (Hatigarda)
	Storativity (S)	:	$1.9 * 10^{-5}$ (Belbhari) – $1.7 * 10^{-3}$ (Hatigarda )
	Transmissivity (m <sup>2</sup> /day)		55(Chandanpur) – 1631 (Devipatan )
11.	GROUND WATER QUALITY		
	Presence of Chemical constituents more than permissible limit (e.g. EC, Cl, F, No3)	:	As (nd –102 ppb)
12.	DYNAMIC GROUND WATER RESOURCES (As on 31/3/2009)		
	Annual Replenishable Ground Water Resources	:	88595.63
	Gross Annual Ground Water Draft	:	43348.1
	Projected Demand for Domestic industrial Uses upto 2033	:	6290.41
	Stage of Ground Water Development	:	48.93 %
13.	AWARENESS AND TRAINING ACTIVITY		
	Mass Awareness Programmes organized	:	Nil
	Water Management Training Programme organized	:	Nil
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	:	NA
	Projects completed by CGWB (No & Amount spent)	:	NA
	Projects under technical guidance of CGWB (Numbers)	:	NA
15.	GROUND WATER CONTROL AND REGULATION		
	Number Of OE Blocks	:	Nil
	No of Critical Blocks	:	Nil
	No of blocks notified	:	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	:	Arsenic reported at some places. Some part is prone to water logging

## 1.0. INTRODUCTION

Within the realm of Central Ganga Plain of Uttar Pradesh, the district of Balrampur forms an entity. It covers an area of 3349 sq.km and is bounded by North latitudes 27° 03' and 27° 52' ; East Longitudes 82° 01' and 82° 45' in the Survey of India degree sheets 63 E and 63 I. In the north lies Nepal and in the east it faces Siddharthnagar and Basti district. Shrawasti district lies to the west of it while in south; district is bounded by Gonda district (Plate- I). The total geographical area of the district is 3349 km<sup>2</sup>. Administratively, the district is divided into 3 tehsils and 9 developmental blocks. Detail of administration of the district has been given below

**Table 1 Area and Population of the Balrampur District, U.P.**

<b>BLOCK</b>	<b>TEHSIL</b>	<b>BLOCK AREA (Sq Km )</b>	<b>POPULATION (2001)</b>
HARAYA SATGHARWA		473.97	200341
BALRAMPUR	BALRAMPUR	430.04	249116
PACHERWA		375.28	166290
TULASIPUR	TULASIPUR	401.68	207622
GASERI		454.26	192976
SRIDUTTGANJ		174.90	128642
UTRAULA	UTRAULA	149.17	120656
GAINDAS BUZURG		147.81	113493
REHRA BAZAR		225.88	165999
Total Block		2832.99	1545135
Total Forest		413.98	1635
Total Rural		3328.62	1546770
Total Urban		20.38	135580
Total District		3349.00	1682350

## **1.1 Drainage:**

River Rapti is the major river draining Balrampur district and flows from the north-west towards south-east. The river divides the district into two parts. There are large number of ephemeral (Dhobania, Kharjhar, Bhambhar etc.) and few perennial nalas, in the northern part, flow southwards into the Rapti River. South of the Rapti River, there are two other tributaries (Suwawan and Kuwana) which run almost parallel to Rapti before their confluence in the adjacent Basti District.

It has been observed that the tributaries of the Rapti river flow from north to south, but those on the right bank, i.e. south of Rapti are more wandering and generally have an eastward flow. It would thus appear that, in the southern part of the district, the watershed slopes from west to east, whereas it slopes from north to the south in the area north of Rapti.

## **1.2 Irrigation:**

The irrigation facilities have been developed to a considerable extent in the whole of the district. For larger part of the district, groundwater serves as the assured source of supplemental irrigation. During the year 2010-11, about 89.9 % of the net sown area was irrigated through groundwater resources. There are a few minor irrigation projects and one medium irrigation project i.e. Chittorgarh reservoir project. Surface irrigation practice is largely in vogue in these and adjoining areas.

The area irrigated area in Balrampur district by different sources is given in Table-2. The total irrigated area by different sources is 709.76sq km. Out of which 88 % of the area is irrigated by tubewells, Govt. & private and borings, 5.1 % of the area is irrigated by canal and rest is irrigated by other source.

**Table- 2 Blockwise area (hectare) irrigated by different sources, Balrampur district, U. P. (2010- 11)**

Block	Canals	Tubewell		Wells	Ponds	Others	Total
		Public	Private				
1	2	3	4	5	6	7	8
1. Haraya Satgharwa	606	105	8657	203	1254	0	10825
2. Balrampur	0	337	10601	174	377	0	11489
3. Tulsipur	732	316	7829	35	107	0	9019
4. Gesari	1388	137	9225	157	789	0	11696
5. Pachperwa	926	122	6626	162	792	0	8628
6. Shri Dutt Ganj	0	268	4658	31	46	0	5003
7. Utraula	0	142	4059	41	72	0	4314
8. Gaindas Buzurg	0	101	4271	20	20	0	4412
9. Rehra Bazar	0	167	5308	50	65	0	5590
<b>Total</b>	3652	1695	61234	873	3522	0	70976

### 1.3 Previous works

Hydrogeological investigation studies in the Balrampur District, part of the erstwhile Gonda District, were first carried out by Sri B.D. Pathak during the year 1956 and subsequently by other officers viz., Sri M.C. Dubey (1969), Sri P.J.S. Bhamrah (1969), Sri B.K. Baweja (1970). *Ground Water Potential of Gonda District, Uttar Pradesh* was the first detailed unpublished report by Shri B.D.Pathak, Director, and Sri S.A.H. Jaffery, Junior Hydrogeologist and Sri O.P.Pal, Junior Hydrogeologist, during the year 1978. Sri S.N. Sinha, Scientist 'B' and Sri A.K. Bhargava, Assistant Hydrogeologist, carried out reappraisal

Hydrogeological Surveys during the year 1990-91. Reappraisal Hydrogeological Surveys were again carried out by Sri J.P. Gautam, Scientist 'B' (1998-99) and Sh Avnish Kant Sc-B(2004-05).

Central Ground Water Board, under its ground water exploration programme, has carried out deep drilling down to a maximum depth of 751 mbgl at Devipatan (Tulsipur) to identify and demarcate aquifer system in the area besides estimating aquifer parameters. A total of sixteen (16) number of tubewells have been sunk by CGWB under normal exploration while 3nos of tubewell were constructed for Arsenic studies.

## **2. CLIMATE AND RAINFALL**

The district experiences sub- humid climate and three distinct seasons viz. summer, rainy and winter seasons. The climatological data gives an idea of the hydrometeorological condition in the district. The hottest month is May with average mean temp. of 34.8 ° C followed by June with 34.3 ° C. The coldest month is January with average mean temperature of 16.15 °C followed by December with 16.95° C. The relative humidity is highest in month of August with normal relative humidity of 81%, followed by July & Sept. with normal value of 75.5%.The normal annual mean wind speed of the district is 5.16 km/h. The maximum normal wind speed is 8.0 km/h in the month of June and minimum wind speed is observed in winters as 2.6 km/h in the month of November.

The annual normal Rainfall (1901-1970) of the district comes to 976.73 mm. The maximum rainfall occurs during the monsoon period i.e. June to Sept. having the normal value of 870.67 mm which is 89.14 % of annual rainfall. July is the wettest month having the normal rainfall of 306.73mm followed by August with Normal rainfall of 297.77mm.

### **3.0 GEOMORPHOLOGY & SOIL TYPE**

#### **3.1 Physiography, Geomorphologic features and Landforms**

The district area, in general, comprises of undulating plains. The district can be almost identifiably divided into two units, the upland plains underlain by Older Alluvium and the lowland plains underlain by Newer Alluvium.

The elevation of the land surface varies from about 160 m amsl at Bankatwa in the north western part of the district to 96.5 m amsl at Sadulla Nagar, Block Rehra Bazaar in the south east. The general slope of the tract is from northwest to southeast. The topography is largely influenced or modified by the existing network of rivers and streams.

##### **3.1.1 Upland Plains:**

The northern part of the district comprises of the uplands and gently undulating plains. This is the area just south of Nepal Himalayas and Siwaliks and comprised of Bhabhar formations. Geomorphologically, the area is characterised by Pedimont Plains and Pediplains. The general slope of the uplands is towards south.

##### **3.1.2 Lowland Plains**

This is area further south of the Upland Plains. It comprises of Younger Alluvium and has a comparatively gentler slope. Rapti River flows through the Lowland Plains and is characterised by a several sand bars and vast alluvial tracts. The meander flood plains occur in the central part of the district, all along the Rapti River as well as the other perennial nalas. These plains are low lying river areas situated between 98 and 110 meters above mean sea level.

#### **3.2 Soil Characteristics**

The soils of the district consist broadly of “*Matiyar*” or clay, “*Dumat*” or loam. The hard clay soil or *Matiyar* is ideal for rice cultivation and very fertile. The *Dumat* or loam is also fertile soil, ideal for cultivation of various types of crops. This is the reason for high crop yields in the district. The soil cover is generally shallow and moderate in the northern part while in the southern part the soil cover is thick.



## **4.0. GROUND WATER SCENARIO**

### **4.1 Hydrogeology:**

#### **4.1.1 Water Bearing formations**

The thick unconsolidated sediments have been explored for ground water availability and utility. The Rapti Alluvial plains in Balrampur district comprise of an aquifer system that forms good repository of ground water that occurs in granular zones constituted of coarse sand and occasional gravels. Thick clays, which are predominant, act as the confining layers and separate the aquifers.

#### **4.1.2 Aquifer geometry**

Alluvial tract of Balrampur district is underlain by sands of various grades, gravels, silt and clay. The result of exploratory drillings indicates that the aquifers vary great deal in extent, both vertically as well as laterally. The southern part of the district is characterized by thicker aquifers, where sand and gravel predominate over clays. The northern part comprises of thinner granular zones and lenses of sand of varying lateral extent, dominated by thick clay. Broadly, a three (3) tier aquifer system can be inferred in the area down to a depth of 350 m bgl. The sticky and yellowish clay marks the boundary between these aquifers at 120 m bgl and 210 m bgl. Ground water in the topmost aquifer occurs under phreatic or water table conditions while in intermediate and deeper aquifer it occur under semi confined to confined condition.

#### **4.1.3 Depth To Water Level:**

As per depth to water level data of ground water monitoring stations of Balrampur of year 2012, pre monsoon water level varies from 3.5 mbgl (Pachperwa) to 8.05 mbgl (Bankatwa)

.In Post monsoon period depth to water level varies from 1.85 mbgl (Sonpur) to 9.18 mbgl (Bankatwa). Water level fluctuation varies from -1.13 to 1.5 meters. The perusal of the depth to water level map reveals that depth to water level in the northern part is deep, showing the depth to water level in ranges of 5 -10 mbgl whereas in the central of the district shallow water levels(2-5 mbgl) are observed .

#### **4.1.4 Long Term Water Level Trend**

Long term(2003 – 2012) water level behavior of the ground water regime has been studied from the water level data of the ground water level monitoring stations of CGWB. Most of wells shows falling trend during pre-monsoon while during post-monsoon long term ground water level show rising trend. The highest rise in the water levels was observed at Jarwa (0.31 m/year).

#### **4.1.5 Aquifer with yield, well and aquifer details**

A total of sixteen (16) number of tubewells have been constructed by CGWB in Balrampur district under its ground water exploration programme. The highest discharge of 3235 lpm was observed at Hatigarda and the lowest discharge was observed at Jarwa (1904 lpm). Most aquifer parameters have been determined at various places. The drawdown in most of the tubewells is in the range of 6m, at Hathigarda to as high as 30 metres at Chandanpur in the piedmont area. The Coefficient of Transmissivity has been determined to be in the range of 55 m<sup>2</sup>/day (at Chandanpur) to as high as 1631 m<sup>2</sup>/day (at Devipatan). The low Transmissivity at Chandanpur can be explained due to proximity to piedmont tract and small thickness of aquifer. The Storativity of the aquifers has been estimated to be in the range of 1.9 x 10<sup>-5</sup> to 1.7 x 10<sup>-3</sup> at Belbharia and Hathigarda respectively.

#### **4.2 Ground Water Resources:**

Ground water is the most dependable source of irrigation as wells as domestic and industrial water supply, due to its assured and timely supply and low lost structures. In Balrampur district, ground water resources cover about 80% of the net irrigated area, and its demand is increasing regularly with growing population and other developmental activities. As per report on Dynamic Ground Water Resources of Utter Pradesh as on 31.03.2009 annual ground water availability of the district is 88595.63 ham .The Gross ground water draft for all uses is 43348.09 ham .The stage of ground water development is 48.93 %. As per the estimates worked out, all blocks are under 'safe' category .

**Table –3 Dynamic Ground Water Resources Balrampur District, U.P.( 31.03.2009)**

<b>Sl. No.</b>	<b>Assessment Units - Blocks</b>	<b>Annual G W Recharge ( ham)</b>	<b>Net Annual GW Availability ( ham)</b>	<b>Existing Gross GW Draft For All Uses ( ham)</b>	<b>Net GW Availability For Future Irrigation Development ( ham)</b>	<b>Stage of GW Development (%)</b>	<b>Category of Block</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
1	BALRAMPUR	13604.45	12924.23	10742.62	1756.62	83.12	<b>SAFE</b>
2	GAISADI	12737.68	11463.91	3366.73	7793.60	29.37	<b>SAFE</b>
3	GIDAS BUZURG	4053.21	3850.55	2404.78	1332.53	62.45	<b>SAFE</b>
4	HARRAIYA SATGHARWA	19987.53	17988.78	5799.78	11899.18	32.24	<b>SAFE</b>
5	PACHPERVA	13077.20	11769.48	2157.50	9359.82	18.33	<b>SAFE</b>
6	REHRA BAZAR	7632.96	7251.31	5571.35	1454.70	76.83	<b>SAFE</b>
7	SRIDUTTGANJ	5654.33	5371.61	4758.97	469.34	88.59	<b>SAFE</b>
8	TULSIPUR	13835.08	13143.33	4284.16	8489.41	32.60	<b>SAFE</b>
9	UTRAULA	5086.77	4832.43	4262.20	439.22	88.20	<b>SAFE</b>
	<b>TOTAL</b>	<b>95669.21</b>	<b>88595.63</b>	<b>43348.09</b>	<b>42994.42</b>	<b>48.93</b>	

### 4.3 GROUND WATER QUALITY

Ground water in the phreatic aquifer in general is colourless, odourless and slightly alkaline in nature. Specific Conductance (EC), which is a measure of total dissolved solids, indicates the ground water in the district is fresh and the EC values range from 325 to 792  $\mu$  mhos/cm at 25°C. The arsenic value in the district has been found from 1 to 102 ppb and fluoride ranges from 0.18 to 0.64 mg/l. It is observed that the ground water is suitable for drinking and domestic uses except at few places where As occurs above permissible limit. The quality of ground water in deeper aquifer is also potable.

### 4.4 STATUS OF GROUND WATER DEVELOPMENT

In Balrampur district ground water development takes place through Private and State tubewells and borings with Pumpsets. The ground water development in the district ranges between 18.33% (Pachperwa block) and 88.59% (Shriduttganj block) through various structures. In all blocks of the district ground water development takes place through dug wells, bore wells and State tubewells. The relevant details are given below.

S.No.	Type of structure	Number	Depth range (mbgl)	Yield (lpm)
1.	Dug wells	122	5.50-30.50	50-100
2.	State tubewells	303	80-411	2000-3200
3.	Borewells	50744	20-60	120-300

The wells generally meet out the domestic requirements. There are 47457 diesel pump sets used in bore wells for irrigation. Maximum number of pump sets is in Balrampur block i.e. 9804. State tubewell constructed by State Tube well division for irrigation. CGWB has drilled an exploratory well in the district upto 751 m bgl and tapping granular zone upto 580 m bgl at Devipatan. (Tulsipur)

**Table 4 Blockwise status of sources of irrigation in district / block (31st march 2011)**

Block	Canal length (km)	Govt. tubewell (No.)	Perma- nent wells (No.)	Rahat (No.)	Pumpsets				Ground pumpset (No.)
					Electricity Run (No.)	Diesel Run (No.)	Other (No.)	Total (No.)	
1. Haraya Satgharwa	66	5	16	2	39	7718	451	8208	38
2. Balrampur	98	74	17	0	236	8883	685	9804	32
3. Tulsipur	60	50	12	0	24	5184	232	5440	8
4. Gesari	115	66	16	0	21	6497	281	6799	18
5. Pachperwa	151	8	16	0	23	6716	276	7015	6
6. Shri Dutt Ganj	86	38	10	2	12	3273	208	3493	0
7. Utraula	47	19	12	0	12	3574	287	3873	6
8. Gaindas Buzurg	13	14	9	0	11	1465	81	1557	0
9. Rehra Bazar	0	29	14	2	65	4147	343	4555	0
<b>Total</b>	<b>636</b>	<b>303</b>	<b>122</b>	<b>6</b>	<b>443</b>	<b>47457</b>	<b>2844</b>	<b>50744</b>	<b>108</b>

Drinking water tubewells have been constructed in town area and villages for providing water through pipeline scheme. Depth of drinking water tubewells tapping 15 to 30 m granular zones varies from 75 to 320 mbgl. The yield of tubewells varies from 1000 lpm to 3200 lpm. In rural area India Mark II Hand pumps have also been constructed for drinking water that benefited population of the district. Depth of these hand pumps varies from 25-50 m. Centrifugal pumps is commonly used for lifting water from shallow tubewell while submersible pump is used in deep well for high lift of water.

## **5.0 GROUND WATER MANAGEMENT STRATEGY**

### **5.1 Ground Water Development**

The stage of ground water development in the district is 56.58 %. Ground water development in Harriya Sheopura, Gaisari, Pachperwa and Tulsipur block is very low (22 % - 34 %). Depth to water level is shallow in most part of the district, shallow tubewell (upto depth of 35 m), constructed by hand boring sets, is suitable to meet out the domestic irrigation requirement. Rotary (direct/Reverse) is suitable for construction of shallow tubewell. Deep tubewell is constructed through direct rotary method. The well assembly for moderately deep tubewells may have 40-50 m housing, tapping 30 to 40 m of granular zone. Since fine sand is encountered in granular zones, it is advised that slot size should be between 0.75 to 1.00 mm. To increase the life and discharge of well, after lowering of well assembly tube well should be developed initially by air compressor followed by turbine pump till water is sand free.

### **5.2 Water conservation structure & artificial recharge**

Depth to water levels are within 5m bgl, during post monsoon in most of the area of Balrampur district, artificial recharge is not required. CGWB has not constructed any recharge structure in the district

## **6.0 GROUND WATER RELATED ISSUE AND PROBLEMS**

### **6.1 Water quality problem (geogenic)**

The chemical analysis of ground water samples collected indicates that the problem of Arsenic pollution in ground water has taken serious dimensions in certain parts of Balrampur district. High concentration of Arsenic was observed in the ground water samples collected from India Mark – II hand pumps as well as Cast Iron hand pumps. None of the ground water samples collected from deep tubewell showed the presence of Arsenic above the permissible limits. The map showing potentially affected areas due to Arsenic pollution in ground water (Plate V) shows that the problem is more acute in Pachperwa, Gaindas Buzurg, Gainsuri and Harraiya Bazaar blocks. Interaction with local villagers was very helpful in identifying probable Arsenic affected areas. Few villagers were identified who were suspected of having been affected by arsenic pollution.

Arsenic may be found in water owing to its mobilisation through arsenic-rich rocks. Concentrations of arsenic in fresh water vary in magnitude depending on the source of arsenic as well as local geo-chemical environment. Under natural conditions, the elevated

concentrations of arsenic are generally found in the ground waters as a result of the strong influence of water-rock interactions.

## **6.2 Drilling problems**

Due to presence of boulder and clay in the northern part of the district, problem in drilling is encountered. Thickness of clay zones in central and southern part of district is less , due to which borehole wall is very unstable during drilling. Therefore, a thick mud should be used during drilling.

## **6.3 Risk to natural disaster**

NA

## **7.0 AWARENESS AND TRAINING AVTIVITY**

No programme /activity has been organized in the block so far.

## **8.0 AREA NOTIFIED BY CGWA/SGWA**

None

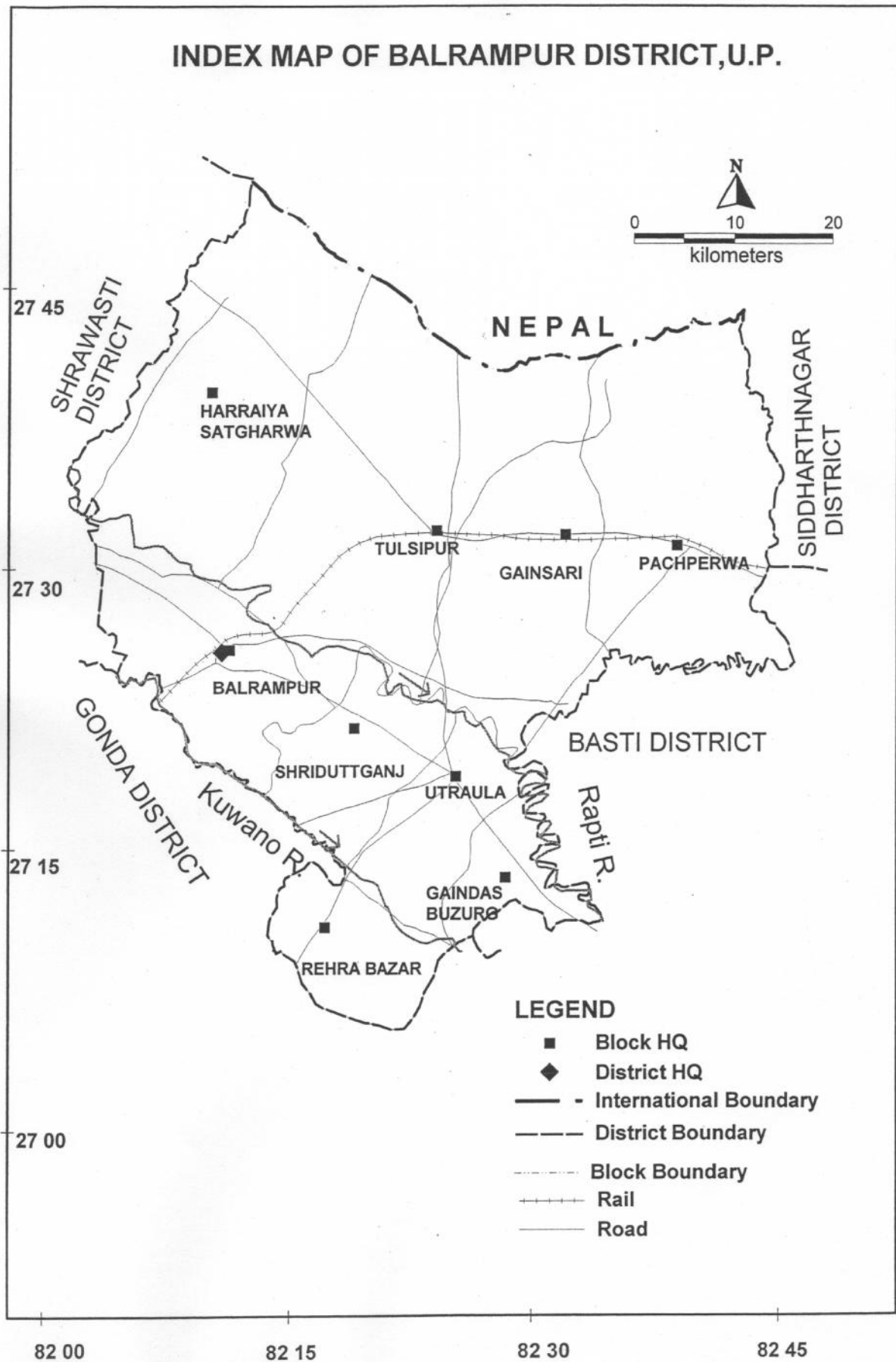
## **9.0 RECOMMENDATIONS**

Following recommendation have been made to sort out ground water problems related to groundwater development and ground water generated diseases.

1) The problem of Arsenic pollution in ground water in Balrampur district has to be immediately addressed to. The first and the foremost task is to identify the villages where Arsenic concentration is above the maximum permissible limit defined by BIS (IS 10500 – 91). Arsenic field-testing kit could prove to a very useful instrument to commence the detailed investigations in these areas.

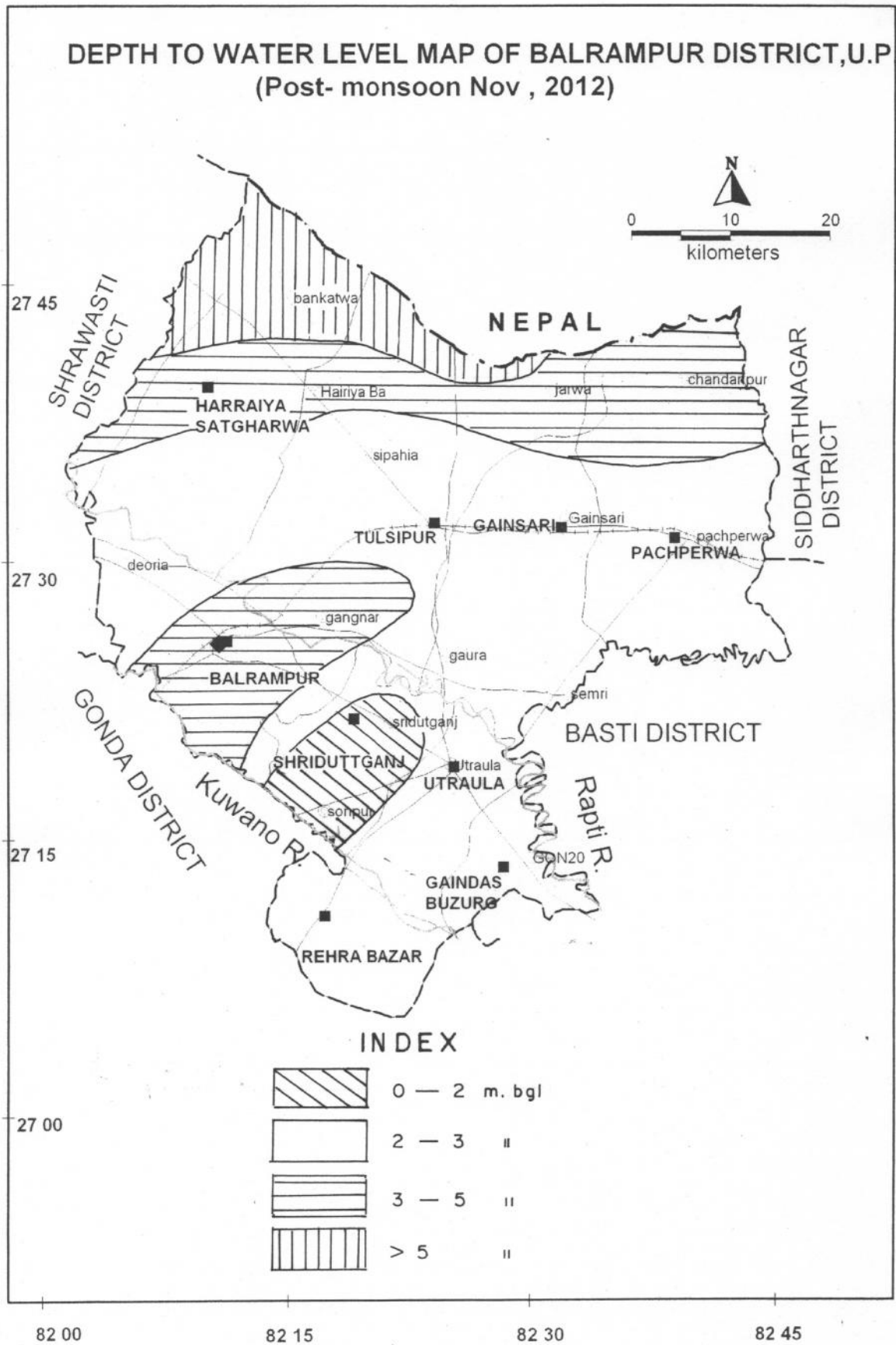
2) Certain hand pumps yielding water with higher Arsenic concentration may be demarcated like being painted red etc. These markings would indicate that these pumps are not fit to be used for catering to human or livestock needs. Alternative sources of ground water may be identified and recommended for use. For example, if Cast Iron hand pumps in a village are found to contain Arsenic higher than permissible limit, India ground water. Mark –II hand pumps tapping aquifers at greater may yield ground water having arsenic less than the permissible limit.

3) The most important aspect of any pollution study is *not to scare but make people aware*. It is imperative to make people aware of the groundwater structures having high concentration of arsenic. The objective is to educate them – to use and/or avoid groundwater structures according to arsenic content in water.











HYDROGEOLOGICAL MAP , BALRAMPUR DISTRICT, U.P.



HYDROCHEMICAL MAP, BALRAMPUR DISTRICT, U.P.  
( 2012)

