

# **GROUND WATER BROCHURE OF GORAKHPUR DISTRICT, UTTAR PRADESH**

*(A.A.P.: 2012-2013)*

*By*

**P.K. Singh**

Scientist – B

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## **GORAKHPUR DISTRICT AT A GLANCE**

### **1. GENERAL INFORMATION**

i. Geographical Area (Sq. Km.)	: 3321
ii. Administrative Divisions (as on March 2012)	:
Number of Tehsil/Block	7/19
Number of Panchayat/Villages	1233/3327
iii. Population (as on 20011-12)	: Male 1532720 Female 1498115 Total 3030865
iv. Average Annual Rainfall (mm)	: 1221.00

### **2. GEOMORPHOLOGY**

Major Physiographic Units	: Older & Younger Alluvium
Major Drainages	: Ghaghra / Rapti & its tributaries

### **3. LAND USE (Sq. Km.)**

a) Forest area	: 57.54
b) Net sown area	: 2438.38
c) Cultivable area	: 2438.83

### **4. MAJOR SOIL TYPES**

: Alluvial soil

### **5. AREA UNDER PRINCIPAL CROPS (as on 31-3-2012)**

: Rabi, Kharif, Jayad

### **6. IRRIGATION BY DIFFERENT SOURCES**

(Areas under Sq. Km.)

Dugwells	: 0.19
Tubewells/Borewells	: 107.04/1959.71
Tanks & Ponds	: 1.12
Canals	: 22.41
Other Sources	: 0.00
Net Irrigated Area	: 2066.75
Gross Irrigated Area	: 2090.47

### **7. NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2012)**

No. of Dugwells	: 07
No. of Piezometers	: NIL

### **8. PREDOMINANT GEOLOGICAL FORMATIONS**

: Gravel, Sand, Clay,  
Kankar

## 9. HYDROGEOLOGY

Major water bearing formation	: Gravel, Sand, Clay, Kankar
(Pre-monsoon Depth to water level during 2012)	: 3.57 - 7.66 mbgl
(Post-monsoon Depth to water level during 2012)	: 1.47 - 4.49 mbgl
Long term water level trend in 10 years (2001-2012) in m/yr	: Premonsoon – Fall upto 0.0412 to 0.1409 m/yr. at 2 stations and Postmonsoon – Fall upto 0.0267 to 0.0291 m/yr. at 2 stations.

## 10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2012)

No of wells drilled (EW, OW, PZ, SH)	: EW-04, OW-01
Depth range (mbgl)	: 449.19 (Maximum use)
Discharge (litres per second)	: 2195
Storativity (S)	: -
Transmissivity (m <sup>2</sup> /day)	: 1034

## 11. GROUND WATER QUALITY

Presence of Chemical constituents more than permissible limit (e.g. EC, As, Fe)	: Within permissible limit
Type of water	: Good

## 12. DYNAMIC GROUND WATER RESOURCES (2009)-in Ham

Annual Replenishable Ground Water Resources	: 147151.44
Net Annual Ground Water Draft	: 97093.72
Projected Demand for Domestic & Industrial Uses upto 2025	: 11431.21
Stage of Ground Water Development	: 65.98%

## 13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programmes organized	: NIL
Water Management Training Programme organized	: NIL

## 14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING

Projects completed by CGWB (No. & amount spent)	: NIL
Projects under technical guidance of CGWB (Numbers)	: NIL

## 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

	: Water logging and flood prone
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# **GROUND WATER BROCHURE OF GORAKHPUR DISTRICT, UTTAR PRADESH**

(A.A.P.: 2007-2008)

By

**P.K. Singh**

Scientist – B

## **1.0 INTRODUCTION**

### **ADMINISTRATIVE DETAILS:**

#### **Location and Area:**

The district Gorakhpur occupies extreme North-Eastern part of Uttar Pradesh and lies between 26<sup>0</sup>15' and 27<sup>0</sup>06' N latitude and 83<sup>0</sup>06' and 83<sup>0</sup>45' E longitude, falling in survey of India Degree Toposheet 63 N. The total geographical area of the district is 3483.815 Km. There are 7 tehsils and 19 blocks. There are 191 Nyay Panchyat, 1224 Gram Sabha and 563 Panchyat Ghar. Gorakhpur is the head quarter of this district.

The district is located in the part of Central Ganga Plain (Plate-I).

#### **1.1 Drainage:**

The drainage system of the district represents a part of the Ganga basin and Ghaghra sub basin. The main river system is controlled by the Ghaghra river and its affluent in the district. There are two direct affluent of Ghaghra viz the Rapti and the kuwana. Rapti river with its tributaries Tarauna Nadi, Ami river and Gaura Nadi form the main drainage of the district. The drainage of the entire district is discharged into Ghaghra. The major sources are Ramgarh Tal, Nandaur Tal, Amir Tal, Bheuri Tal and Taraina Tal. These are useful as sources for minor irrigation & fisheries.

#### **1.2 Studies of C.G.W.B.:**

C.G.W.B. has completed systematic hydrogeological survey and ground water management studies are being carried out to assess change in ground water regime periodically. Apart from this, ground water exploration is being carried out to delineate the aquifer geometry and to know the aquifer characteristics, special

attention has been given to identify the deeper aquifers and construction of deep tubewells and to compute the hydraulic parameters.

## **2.0 RAINFALL AND CLIMATE**

### **RAINFALL:**

The normal rainfall is of tune of 1379.20 mm. The most of rainfall in the area occurs from south west monsoon from mid June to September. During the rest of the year, the rainfall is sporadic and scanty.

### **CLIMATE:**

The climate is sub-humid to humid and is influenced to some extent by the proximity of the north and the existence of Terai swamps. About 87% of rainfall takes place from June to September. During monsoon surplus water is available for deep perlocation to ground water.

January is the coldest month with mean daily maximum temperature at 23<sup>0</sup>C and mean daily minimum temperature at 9.9<sup>0</sup>C. May is the hottest month with mean daily maximum temperature at 39<sup>0</sup>C and mean daily minimum temperature is 25.9<sup>0</sup>C. With onset of the monsoon day temperature drops appreciably but nights continue to be warm. The mean monthly maximum temperature is at 31.9<sup>0</sup>C while mean monthly minimum temperature is 19.8<sup>0</sup>C. During the monsoon and post-monsoon seasons the relative humidities are high and decreases in winter months. The mean monthly morning relative humidity is 69% and mean monthly evening relative humidity is 53%.

Winds are generally light with a slight increase in force in the late summer and southwest monsoon months. The mean wind velocity is 4.1 Km/hr.

The potential evapotranspiration is 1422.7 mm.

### **Floods:**

District is always affected by flood. When the stream discharge exceeds the channel capacity. Water rises over the channel banks and flood the adjacent low lying land. The main causes of flood in the district are

- (a) Sedimentation
- (b) Due to erosion of banks and spur formation.
- (c) Due to local bending
- (d) Due to monsoonal rains
- (e) Back flow of nullahs and drainage system according to inscriptions and descriptions available the historical record of floods in the Gorakhpur district are noticed in years 1832, 1839, 1871, 1892, 1903, 1906, 1910, 1922, 1924, 1925, 1927, 1928, 1929, 1930, 1932, 1953, 1954, 1956, 1957, 1958, 1960, 1961, 1967, 1968, 1970, 1971, 1973, 1974, 1993, 1998, 2000, 2001, 2005 in which 1998 flood in Gorakhpur district was disastrous.

### 3.0 GEOMORPHOLOGY AND SOIL TYPES

#### GEOMORPHOLOGY:

Based on the map prepared by remote sensing application centre, Lucknow using IRS-1A imaging and survey of India toposheet, the following geomorphic units have been identified-

- (a) Sand Bar
- (b) Flood Plain
- (c) Alluvium Plain
- (d) Ravines
- (e) Older – Meander Plain
- (f) Ox-Bow-Lakes

Ground water prospects in this geomorphic units are tabulated below:

Geomorphic Units	Ground Water Prospects
Sand bars	Good to excellent
Flood plain	Good to very good
Ravines	Poor
Alluvium plain	Good to very good
Older meander	Good to excellent
Oxbow lakes	Good to excellent

Vegetation anatomy (dense vegetation indicates the presence of loose alluvium material and good quality of ground water)	Good
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**SOIL TYPES:**

The soils of the district are mainly transported i.e. alluvial soil, comprising sand, silt and clay in varying proportions and rich in humus. The alluvial soil of the districts are subdivided into older alluvial soil and younger alluvial soil. The older alluvial soil occupies high land and younger alluvial soils are restricted to marginal tract of Rapti and Ghaghra rivers and both are fertile.

**4.0 GROUND WATER SCENARIO**

**4.1 HYDROGEOLOGY:**

The district Gorakhpur is underlain by quaternary alluvium brought by Ghaghra and Rapti river system. It comprises mainly sand of various grades, sandy clay, silt, clay with varying amount of kankar and gravels. The alluvial deposits are broadly classified under two categories (a) older (b) younger alluvium. The older alluvium deposits known as 'Bangar' or high land soils are due to denudation. The Bangar can be further sub divided into three sub categories on the basis of percentage of the sand content viz Balua containing more than 70% silica, Loam containing silica about 50% and Matiar containing less than 40% silica.

The younger alluvium deposits known as 'Kachhar' occupy the marginal tract of Rapti and Ghaghra and other third order streams and consists of sandy clay and sand along the river tract and fine silt in the gentle sloping plains.

Occurrence of ground water in the area is controlled by Ghaghra and Rapti and their main tributaries. Fine to coarse grained sand, mixed with gravel and kankar form the principal aquifer in the district. Ground water in the area occurs both under confined and water table conditions. It occurs in the zone of saturation within the granular zones encountered below land surface. South and East of Rapti the formation are sandy and suitable for construction of shallow and deep tubewells.

#### **4.1.1 Water Level (Pre and Post monsoon):**

As per water level data 2012 C.G.W.B. during premonsoon the depth to water level ranges from 4.38 to 7.66 mbgl. Along the river water level varies from 7.00 to 8.00 mbgl show that river is effluent in nature. During the post monsoon water becomes shallower in the interfluvium and ranges from 1.47 to 4.49 mbgl, 70% to 80% of the area during this period is under water level 2.00 to 4.00 mbgl indicating excellent recharge due to monsoon. During pre monsoon N.H.S. wells at Urwa Bazar, Jagdishpur, Khajani and Rambagh showing rising trend 0.0115 to 0.0800 m/year and N.H.S. wells at Kuriram, Urwa Bazar showing falling trend 0.0412 to 0.1409 m/year. During post monsoon N.H.S. wells at Rampur, Jagdishpur, Khajani and Ramgarh showing rising trend 0.0618 to 0.3373 m/year and N.H.S. wells at Kuriram and Urwa Bazar showing falling trend 0.0267 to 0.0291 m/year. The movement of ground water is towards the Rapti river which is flowing in N-S direction. The border area of the Bhathat, Sardar Nagar and Brahmpur block show entire behaviour of ground water which may be attributed to the running and closing of canals in proximity. Occurrences of ground water in the area is mainly controlled by three major rivers Ghaghra, Rapti and Kuwana.

#### **4.1.2 Aquifer Characteristics:**

In Gorakhpur district five number of tubewells have been constructed by CGWB upto 200 mbgl depth and one tubewell at Sarpataha upto depth 450 mbgl. Tubewells upto 200 mbgl depth tapped aquifers zones ranging from 40.00 to 50.00mbgl, 80 mbgl - 100.00 mbgl and 180 mbgl – 195.00 mbgl indicating existence of three tier aquifer system.

The discharge varies from 1100 to 2350 lpm and transmissivity range from 113 to 1032 m<sup>2</sup>/day. First and second aquifers upto 100.00 metre and second and third aquifer below 200 metre depth. The deepest tubewell in the district is Sarpataha where tapping of zones start from 236.00 mbgl and zone tapped from 223 to 335.00 mbgl. The discharge of well was 2195 lpm. Except this in the entire district 70 to 180.00 m depth of tubewells were constructed and tapped first and second aquifer upto 100.00 metre and some where second and third aquifer below 180.00 mbgl. The discharge vary from 2733 to 3450 mbgl. The discharge vary from 2733 to 3450 lpm. Deeper tubewells are found in Khajani and Piprauli block area due to thick clay band between first aquifer and second aquifer which range from 85-95 m, 135-170 m of depth



respectively. The discharge of tubewells ranges from 1500 to 2100 lpm. Except this area tubewells are down to depth of 100.00 m and discharge vary from 1200 to 1800 lpm, and along flood plains area the shallow aquifers constructed down to 60 to 70 m tubewells yield 1200 lpm using centrifugal pumps.

The existing data show that 1.50 mm slot size with pea gravel has been used for construction of tubewells. The deeper aquifers have not been utilized as yet. However, the electrical and lithological logs indicate that they have good potential for future development.

#### **4.2 GROUND WATER RESOURCES:**

The dynamic ground water resources of Gorakhpur district have been estimated jointly by CGWB and State Ground Water Department following norms laid down by GEC 1997 methodology and projected as on 2009.

The reconciled figures are as under:

Ground water availability	: 147151.44 ham
Existing gross ground water draft for irrigation	: 89616.46 ham
Existing gross ground water draft for domestic and industrial water supply	: 7477.26 ham
Existing gross ground water draft for all uses	: 97093.72 ham
Net ground water availability for future irrigation development	: 11431.21 ham
Stage of ground water development	: 65.98%
Category of block	: All are safe
Allocation for domestic and industrial supply requirement upto 2025	: 46103.77 ham

#### **4.3 GROUND WATER QUALITY:**

The results of chemical analysis show the following range of various chemical constituents in the ground water:

pH	- 7.90 to 8.17
EC	- 298 to 2010 mu/cm
Chloride	- 12.00 to 265.00 mg/l
Carbonate	- Nil
Bicarbonate	- 110 to 600 mg/l



Sl. No.	Assessment units Block / District	command / Non command / Total	Net annual ground water availability	Existing gross ground water draft for irrigation	Existing gross ground water draft for domestic & industrial water supply	Existing gross ground water draft for all uses (11+12)	Provision for domestic and industrial requirement supply for 2025	Net ground water availability for future irrigation development (10-11-14)	Stage of ground water development (13/10)*100 (%)	Category
1	2	3	10	11	12	13	14	15	16	17
		Non-command	-	-	-	-	-	-	-	
		Total	11028.47	8363.16	606.89	8990.05	498.00	2147.31	81.52	
7.	Chargawan	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	10287.71	5142.39	358.25	5500.64	618.24	4527.08	53.47	
8.	Gagaha	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	7188.21	3622.80	402.56	4025.36	623.07	2942.34	56.00	
9.	Gola	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	7266.38	4082.94	376.23	4459.17	600.25	2583.19	61.37	
10.	Jangle Kuriya	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	9652.33	5597.40	521.62	6119.02	790.62	3264.31	63.39	
11.	Kauriram	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	8243.88	5598.63	398.52	5997.15	625.50	2019.75	72.75	
12.	Khajani	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	7704.06	5786.88	431.08	6217.96	688.63	1228.55	80.71	

Sl. No.	Assessment units Block / District	command / Non command / Total	Net annual ground water availability	Existing gross ground water draft for irrigation	Existing gross ground water draft for domestic & industrial water supply	Existing gross ground water draft for all uses (11+12)	Provision for domestic and industrial requirement supply for 2025	Net ground water availability for future irrigation development (10-11-14)	Stage of ground water development (13/10)*100 (%)	Category
1	2	3	10	11	12	13	14	15	16	17
13.	Khorabar	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	6587.63	2854.08	411.58	3265.66	663.55	3070.00	49.57	
14.	Pali	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	8833.69	6471.31	319.72	6791.03	489.04	1873.34	76.88	
15.	Pipraich	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	6378.38	4458.51	412.59	4881.10	661.31	1248.56	76.53	
16.	Piprauli	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	8470.84	3788.25	410.49	4198.74	643.25	4039.34	49.57	
17.	Sahjanwa	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	9421.25	5304.32	406.44	5710.76	623.56	3493.37	60.62	
18.	Uruwa	Command	-	-	-	-	-	-	-	Safe
		Non-command	-	-	-	-	-	-	-	
		Total	8044.99	4551.35	434.26	4985.61	693.02	2800.62	61.97	
	<b>TOTAL</b>		<b>158479.96</b>	<b>94910.46</b>	<b>7621.19</b>	<b>102531.65</b>	<b>11654.52</b>	<b>51914.98</b>	<b>64.70</b>	

Calcium	- 18 to 50 mg/l
Magnesium	- 17 to 79 mg/l
Total Hardness	- 85 to 700 mg/l
Sodium	- 10 to 174 mg/l
Potassium	- 0.5 to 5.8 mg/l

The quality of ground water is good and potable and fit for all purposes i.e. for domestic irrigation and industrial uses.

## **5.0 GROUND WATER MANAGEMENT STRATEGY**

### **5.1 GROUND WATER DEVELOPMENT:**

At present ground water development in this district is mainly through the shallow tubewells along with few deep tubewells. Which are pumped for drinking water supply and also for irrigation purposes. As per the Ground Water Estimation Committee 2009, the ground water availability calculated as 147151.44 ham. Gross draft for various uses is 97093.72 ham. Thus there is vast potential for future ground water development. The deeper aquifers also have a great potential & sustainability for development.

### **5.2 WATER CONSERVATION STRUCTURE AND ARTIFICIAL RECHARGE:**

No structure has been constructed by CGWB so far in this district.

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

### **6.1 GROUND WATER QUALITY:**

Water samples around Gorakhpur city area, Kauriram, Barhalganj and Ramgarh area containing high bicarbonate, Sulphates and silicates which causes

incrustation and may result in failure of tubewells. Incrustation formed by precipitation of bicarbonates and may easily removed by action of acids or other chemicals. The sugar industries in Gola block, Sahjanawa block area whose untreated effluent may results in ground water pollution. The low cost Katcha latrines in the village area may lead to problem of ground water pollution high Nitrate in the district.

## **6.2 WATER LOGGED AREA:**

The depth to water table condition in the district does not confirm any water logging conditions but prone to water logged area exists in canal commands in north eastern & southern part of district.

## **6.3 AREAS SHOWING DECLINING IN WATER LEVEL:**

The long term water level indicate a declining trend in Kauriram, Urwa Bazar and Jangal Kauri blocks.

## **6.4 DRILLING PROBLEM:**

Only one deep tubewell upto depth of 450.00 mbgl have been drilled so far, High capacity drilling rig is required to explore beyond 450 mbgl to know deeper aquifer geometry & characteristics.

## **6.5 RISK TO NATURAL DISASTERS:**

Natural erosion along the banks of the Ghaghra and Rapti river causing huge loss agricultural and residential land particularly in rainy season is a serious problem in the blocks along the river banks.

## **7.0 AWARENESS AND TRAINING ACTIVITY**

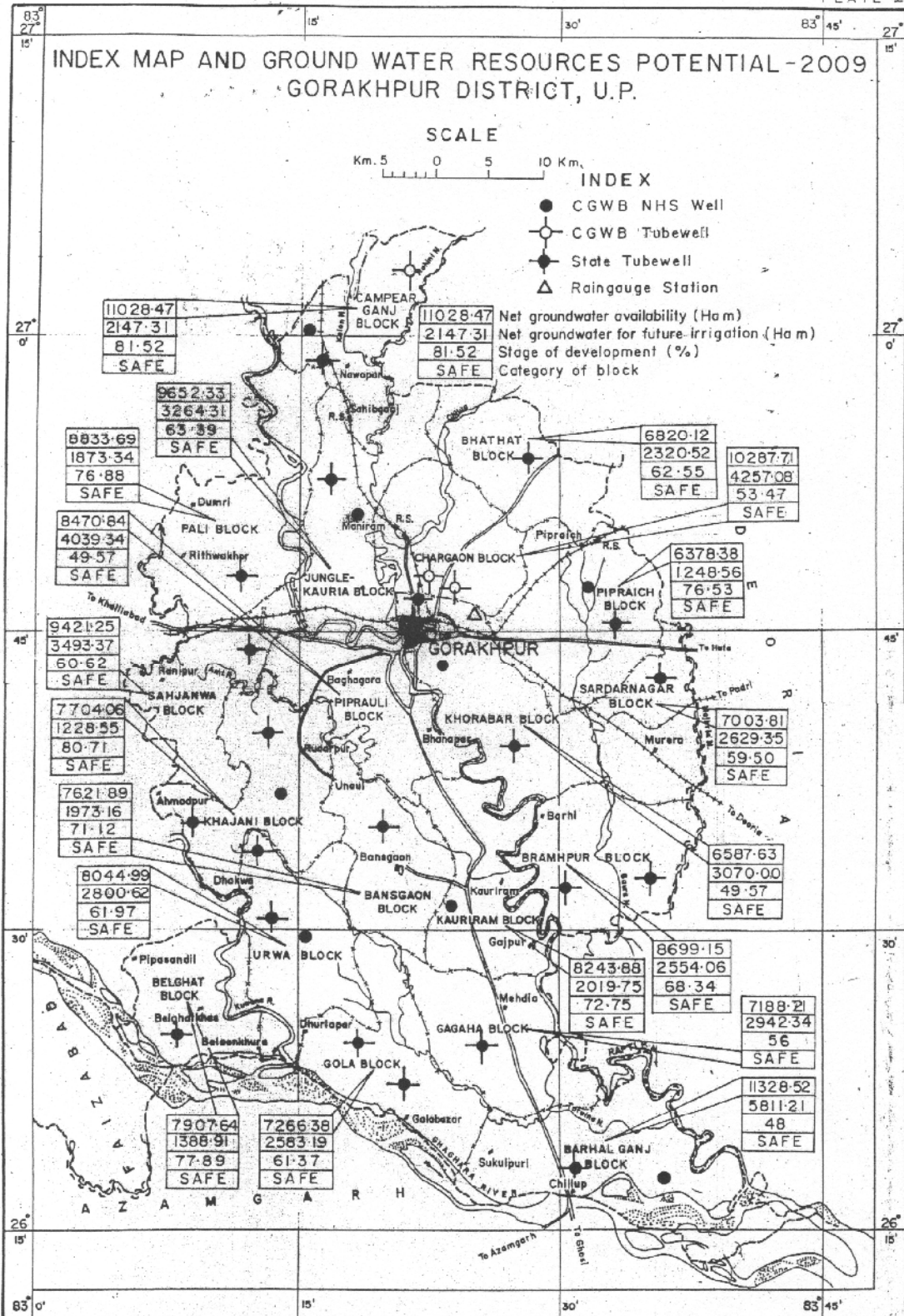
No programme/activity has been organised in the district so far.

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

List of area : Nil

## **9.0 RECOMMENDATIONS**

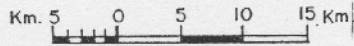
- (a) Geomorphologically, area under flood plain, older meander and near oxbow lakes are suitable for construction of high discharge tubewells.
- (b) For balance of ground water of 46103.77 ham additional 1700 numbers of state tubewells and about 10000 private tubewells and pumping set is feasible in the district.
- (c) The level of development in Belghat, Campeerganj, Khajani, Pali and Piparaich is about 80% therefore it is recommended that the development of ground water in these blocks should be done judiciously with proper monitoring of water level in the area.
- (e) Canal commands areas covering Bhathat, Piparaich, Sardar Nagar, Kherabar blocks where depth to water level is shallow. To avoid future water logging in such area shallow tubewells may be constructed to develop the phreatic aquifer.
- (f) For study the deeper aquifer geometry deep exploration in the district is recommended.
- (g) As indicated by the estimates of ground water resource potential, it is strongly recommended that stress on the use of ground water be given to boost economy of the district by bringing more agricultural area into irrigation.



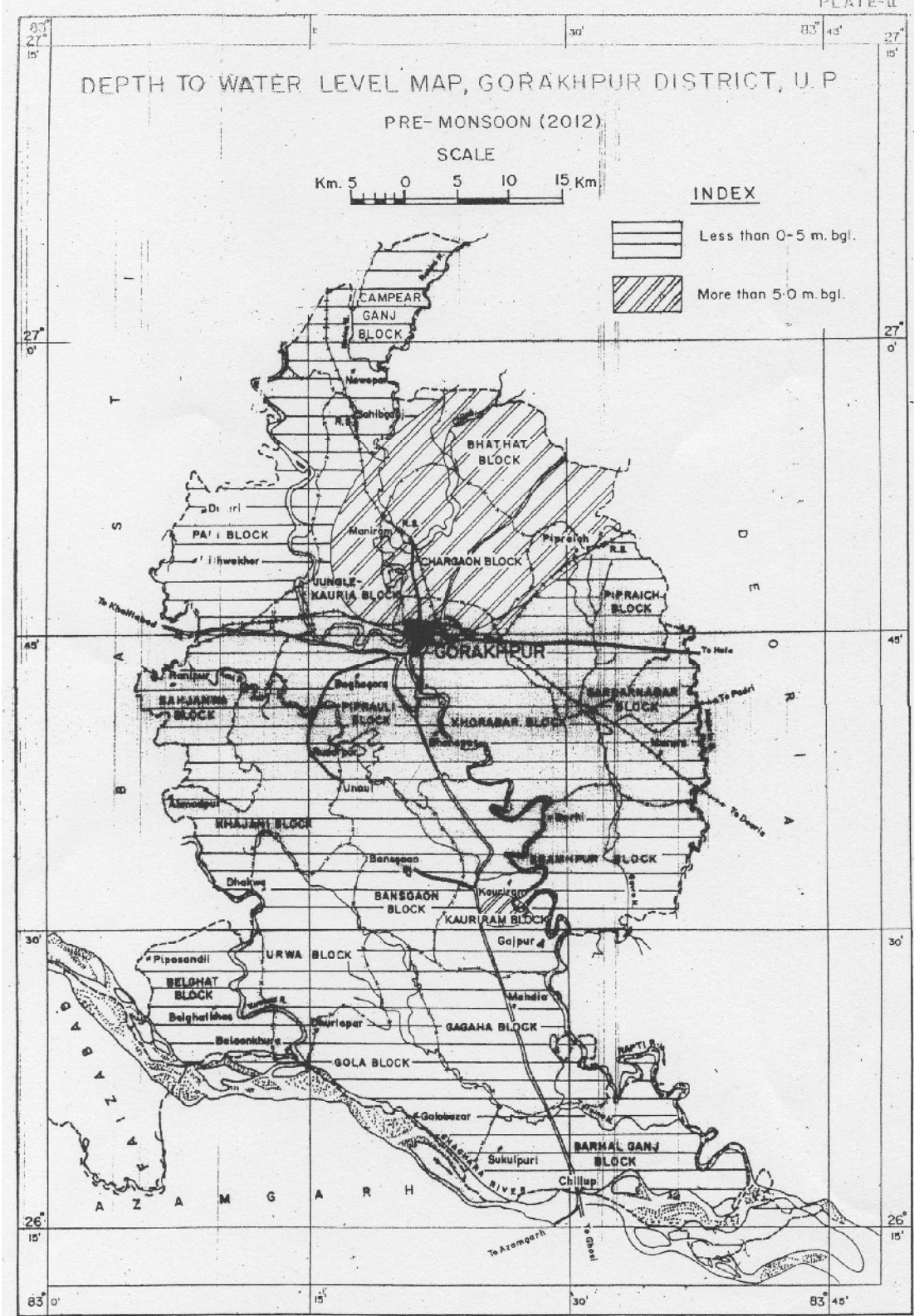
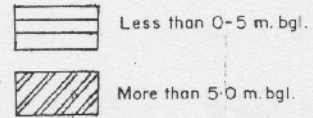


# DEPTH TO WATER LEVEL MAP, GORAKHPUR DISTRICT, U.P. PRE-MONSOON (2012)

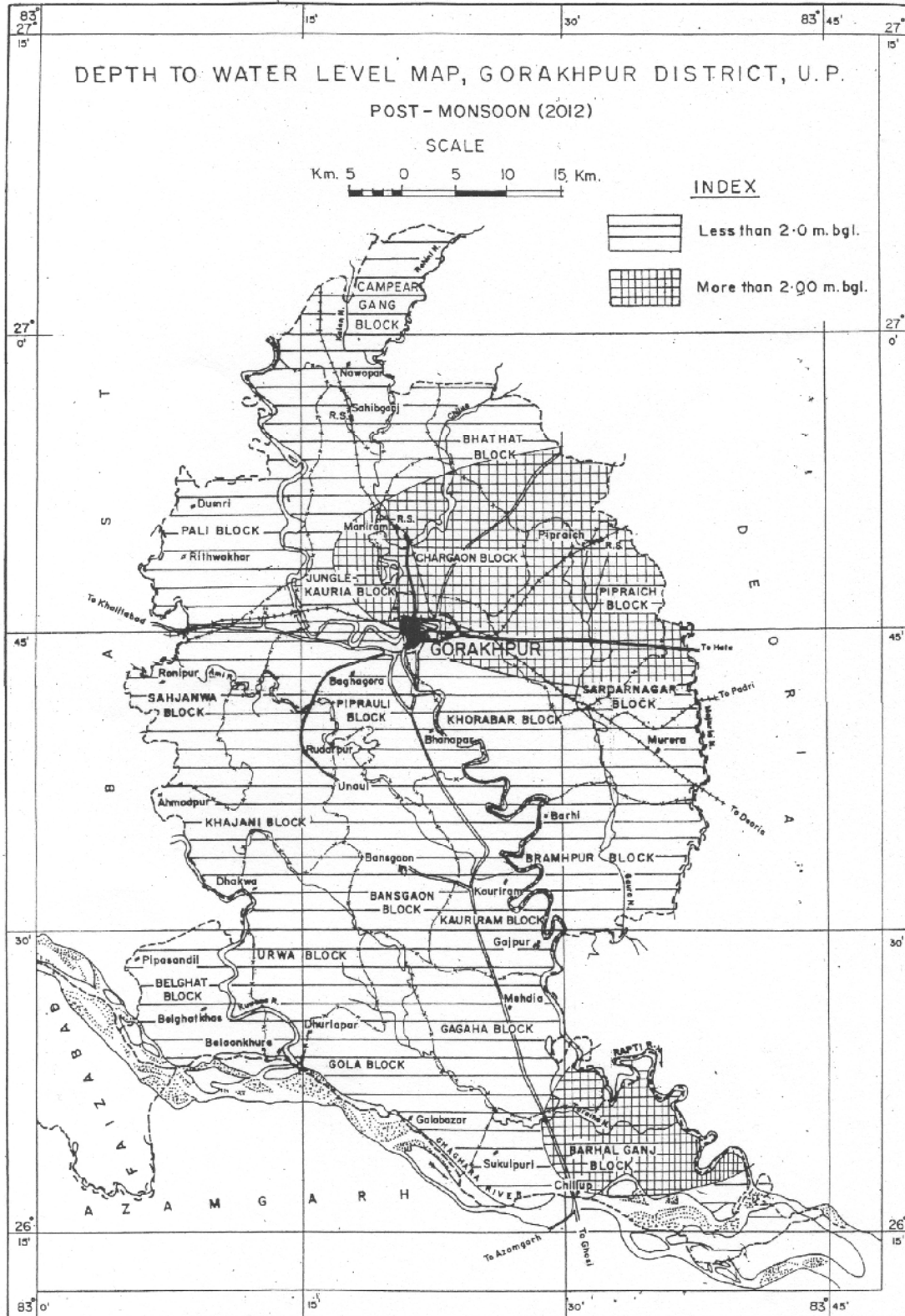
SCALE



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C. G.W.B., N.R., (AKS), Drg. no. 1691/04, (AKS), 4951/13



C. G. W. B., N.R., (AKS), Drg. no. 1691/04, (AKS), 4952/13.