GROUND WATER BROCHURE OF DISTRICT BAREILLY, U.P.

By
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Scientist 'B'

CONTENTS

PLATES:

DISTRICT AT GLANCE

1.	**GENERAL INFORMATION**		
i.	Geographical Area (Sq. Km.)	:	4120
ii.	Administrative Divisions	:	
	Number of Tehsil/Block		6/15
	Number of Panchayat/Villages		1865
iii.	Population (as on 2001 census)	:	36,18,589
iv.	Average Annual Rainfall (mm)	:	1087.90
2.	**GEOMORPHOLOGY**		
	Major Physiographic Units	:	(i) Lower piedmont plain of tarai (ii) Older alluvial plain or upland (iii) Younger alluvial plain or lowland (iv) meander flood plain
	Major Drainages	:	Ram Ganga, Bahagul, Kiccha, Sonka, Deorania, Naktia, Deshara etc.
3.	**LAND USE (Hactare)**		
a)	Forest area	:	285
b)	Net area sown	:	329578
c)	Cultivable area	:	406915
4.	**MAJOR SOIL TYPES**	:	Bareilly type I, II and III Tarai, Khader & Bangar
5.	**AREA UNDER PRINCIPAL CROPS (as on 2006)**	:	Rabi - 237162 hact, Kharif – 280175 hact, Jayad – 23735 hact, Sugarcane – 3617 hact
6.	**IRRIGATION BY DIFFERENT SOURCES** (Areas and Number of Structures)		
	Dugwells	:	1066 ha
	Tubewells/Borewells	:	Govt. T/W 2463 Private T/W 252373 / 269457 ha
	Tanks/ponds	:	2036 ha
	Canals	:	43915 ha by 1360 Km length of canal

	Other Sources	:	16580 ha
	Net Irrigated Area	:	315331 ha
	Gross Irrigated Area		496323 ha
7.	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)**		
	No. of Dugwells	:	12
	No. of Piezometers	:	-
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**		
9.	**HYDROGEOLOGY**		
	Major water bearing formation	:	Sand medium to coarse
	(Pre-monsoon Depth to water level during 2007)	:	2.45 – 14.88 mbgl
	(Post-monsoon Depth to water level during 2007)	:	1.95 – 14.65 mbgl
	Long term water level trend in 10 years (1998-2007) in m/yr	:	
	Premonsoon Declining trend at 4 stations ranging from 0.04 to 0.34 m/yr. Rising trend at 6 stations ranging from 0.01 to 0.47 m/yr. Postmonsoon Declining trend at 7 stations ranging from 0.09 to 0.28 m/yr. Rising trend at 3 stations ranging from 0.03 to 0.21 m/yr.		
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)**		
	No of wells drilled (EW, OW, PZ, SH, Total)	:	EW-8, OW-3, SH-1
	Depth range (m)	:	135 – 240 mbgl
	Discharge (litres per second)	:	14 – 68 lps
	Storativity (S)	:	4.15×10^{-4}
	Transmissivity (m^2/day)	:	1555 to 2120 m^2/day
11.	**GROUND WATER QUALITY**		
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	:	Nil
	Type of water	:	-
12.	**DYNAMIC GROUND WATER RESOURCES (2004)-in MCM**		
	Annual Replenishable Ground Water Resources	:	103333.31 MCM
	Net Annual Ground Water Draft	:	90179.15 MCM
	Projected Demand for Domestic Industrial Uses upto 2025	:	-
	Stage of Ground Water Development	:	58.29% to 109.11%

13.	**AWARENESS AND TRAINING ACTIVITY**		
	Mass Awareness Programmes organized	:	
	Date	:	
	Place	:	3
	No. of participants	:	More than 200
	Water Management Training Programme organized	:	Nil
	Date		
	Place		
	No. of participants		
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING** Projects completed by CGWB (No & Amount spent)	:	Nil
	Projects under technical guidance of CGWB (Numbers)		
15.	**GROUND WATER CONTROL AND REGULATION**	:	Nil
	Number of OE Blocks	:	1
	No of Critical Blocks	:	1
	No of blocks notified	:	Nil
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	:	Declining trend in few blocks

Note: Latest available data may be incorporated.

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1.0 INTRODUCTION

The district Bareilly (also known as Bareli or Bans Bareilly) forms a part of Rohilkhand division and is named after its headquarter city i.e. Bareilly which was founded in 1537 by Bans Deo and Bareldo the two sons of Jagat Singh Katehriya a Rohela Rajput. The Bareilly district is located in the north western part of U.P. and lies between latitude $28^0$01' and $28^0$54' north and longitude $78^0$58' and $79^0$47' east falling in Survey of India toposheet no. 53P. Its maximum length from north to south is about 96 Km and breadth from east to west is about 75 Km.

For the administrative convenience the Bareilly district, a segment at the Rohalkhand commissionery (H.Q. Bareilly) has been divided into six tehsils and fifteen blocks the details are given below and in Plate-I.

Table-1

NAME OF TEHSIL / BLOCK THEIR GEOGRAPHICAL AREA AND DISTANCE FROM DISTRICT HEAD QUARTER

Tehsil	Block	Area in (Sq. Km.)	Block Headquarters	Distance from Headquarter (Km.)
Baheri	Baheri	403.12	Baheri	50
	Richha	243.89	Richha	46
	Shergarh	267.79	Shergarh	42
Mirganj	Mirganj	230.64	Mirganj	33
	Fatehgarh West	178.80	Fatehgarh	17
Bareilly	Bhojipura	195.19	Bhojipura	17
	Kiyara	175.94	Kiyara	8
	Birthi Chainpur	223.47	Birthi Chainpur	13
Aonla	Alampur Jafrabad	278.82	Alampur Jafrabad	22
	Ram Nagar	220.26	Ram Nagar	51

Tehsil	Block	Area in (Sq. Km.)	Block Headquarters	Distance from Headquarter (Km.)
	Majhgawan	300.28	Majhagawan	16
Nawabganj	Nawabganj	335.88	Nawabganj	33
	Bhadpura	242.37	Bhadpura	55
Faridpur	Faridpur	298.38	Faridpur	22
	Bhuta	323.84	Bhuta	34
Total Area	-	3908.22	-	-
Total Urban Area	-	211.78	-	-
Total District Area	-	4120.00	-	-

Bareilly district occupies a part of Ram Ganga sub-basin of Ganga basin being close to the complex watershed of the main Himalayas. In the last few decades, with the rapid urbanisation, expanding industrialisation and increase in agricultural activities in the district, the demand of water has increased manifold. Since the ground water is the most dynamic natural resource for a dependable urban / rural water supply and assured irrigation, It has been extensively exploited in the recent past in the entire district. In some part of the district i.e. Aonla and part of Baheri tehsil it has been extensively exploited, due to non-availability of surface water resources, and the whole ground water regime in the area has been affected resulting in continuous depletion of ground water levels.

Systematic hydrogeological survey was first carried out by Shri M.L. Srivastava and Shri D.L. Shah, Junior Hydrogeologist CGWB / GSI in 1973-74 and 1960-61 respectively. Later Shri A.M. Khan, Junior Hydrogeologist covered the entire district under systematic hydrogeological surveys during F.S.P. 1980-81, Shri R.K. Rajput & Dr. B.C. Joshi Assistant Hydrogeologist CGWB carried out reappraisal survey 1993-94, 1996 and again during the year 2000-2001 reappraisal surveys were carried out by Shri R.K. Rajput, Assistant Hydrogeologist.

2.0 RAINFALL & CLIMATE

The district experiences subtropical climate represented by mainly four seasons vis-à-vis the winter season (Mid November to February), the summer season (Mid March to Mid June), the rainy season (Mid June to Mid October) and the autumn October-November. During the peak summer, the air is generally very dry and hot and the atmosphere becomes dusty due to very high wind velocity, heavy fog is peculiar climatic feature of extreme winter.

(a) Rainfall:

The summer monsoon is the major source of rainfall, which generally lasts from mid-June to mid-October. July and August being wettest months receiving about 319.6 mm and 312.1 mm rainfall respectively. The highest annual normal of rainfall has been recorded at Baheri (1236.8 mm) and lowest at Aonla (979.1 mm), the average of the district being 1087.9 mm (Monsoon-936.6 mm and nonmonsoon-153.1mm). It decreases from more than 1250 mm in the extreme northeast to less than 950 mm in the extreme south. (Monthly and Annual normal of rainfall of Bareilly district is in the Table-II).

(b) Temperature:

The maximum mean monthly atmospheric temperature, 40.5^0C has been recorded during the month of May and minimum (8.6^0C) in January (Table-III). The average annual maximum being 31.5^0C and 18.9^0C respectively.

(c) Humidity:

During the peak monsoon period (i.e. August and September) and in mid winter season (during December) the relative humidity is at highest level ranging between 79% and 84%. While it is lowest around 38% during peak summer month of April and May.

(d) Wind:

The wind speed is generally highest (7.3 Km/hr) during the month of June while it is lowest (2.2 Km/hr) during November, the average annual wind speed is 4.8 Km/hr.

Table-II

MONTHLY & ANNUAL NORMALS OF RAINFALL OF BAREILLY DISTRICT, U.P.

(Based on Data: 1901-70)

Raingauge stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Bareilly Sadar	26.5	24.4	14.9	6.9	15.9	110.3	311.7	304.9	182.2	46.6	3.8	9.0	1057.1
Bareilly Observatory	24.1	24.0	15.5	7.5	16.4	107.5	317.7	294.9	176.0	55.6	4.0	7.7	1050.9
Nawabganj	24.1	26.0	16.2	6.7	21.5	116.7	323.7	312.4	213.7	54.1	4.2	8.4	1127.7
Aonla	23.9	24.1	14.0	7.3	14.6	88.2	289.7	289.6	171.7	45.2	2.3	8.5	979.1
Faridpur	20.7	20.9	13.3	7.7	13.7	107.4	296.8	303.1	177.6	57.7	2.3	8.7	1029.9
Baheri	29.3	34.4	17.3	8.9	21.0	136.6	371.3	351.1	209.0	41.3	4.8	11.8	1236.8
Pandhera	24.5	29.9	15.3	6.8	17.2	119.0	307.8	294.1	176.1	36.8	3.4	8.0	1038.9
Desiiabhoj Diyesh	32.7	28.0	13.9	6.4	17.3	143.8	340.6	331.6	204.5	42.4	2.4	10.7	1174.3
Kundhra	31.2	24.5	15.1	7.4	17.7	112.0	317.0	327.1	201.2	47.9	3.3	8.5	1112.9
District Total	**26.3**	**26.2**	**15.0**	**7.3**	**17.2**	**115.7**	**319.6**	**312.1**	**190.2**	**47.5**	**3.4**	**9.0**	**1089.5**

Table-III

NORMALS OF METEOROLOGICAL FEATURES BASED ON DATA (1931-1980) OF BAREILLY OBSERVATORY, U.P.

Raingauge stations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall	24.5	21.7	13.8	7.6	14.6	102.1	345.6	296.7	171.6	61.7	3.0	5.4	1068.3
No. of rainy days	2.1	1.7	1.6	0.7	1.3	4.9	12.7	13.2	7.4	1.8	0.1	0.6	48.1
Mean maximum temperature (^{0}C)	22.0	24.9	31.0	37.0	40.5	39.0	33.0	32.6	33.0	32.3	28.4	23.8	31.5
Mean minimum temperature (^{0}C)	8.6	10.8	15.6	21.1	25.8	27.5	26.2	25.6	24.7	19.5	12.6	9.4	18.9
Mean highest temperature in month (^{0}C)	25.9	29.7	36.4	41.6	44.2	44.0	38.7	36.1	36.0	35.2	31.6	26.9	44.8
Mean lowest temperature in month (^{0}C)	4.8	6.4	10.5	16.4	21.1	22.9	23.4	23.6	21.5	14.9	8.9	5.5	4.3
Relative humidity (%) (0830 Hr.)	61	73	55	37	39	58	61	84	79	71	70	79	67.0
Relative humidity (%) (1730 Hr.)	54	44	29	21	23	41	71	76	68	52	47	54	49.0
Mean wind speed (Km./hr.)	3.5	4.8	6.0	6.5	6.7	7.3	5.8	4.7	4.2	2.7	2.2	2.7	4.8
Potential evapotranspiration (mm)	48.8	70.6	124.7	166.0	208.5	196.0	129.4	115.5	122.6	110.1	64.2	45.3	1402.3

3.0 GEOMORPHOLOGY & SOILS TYPES

Bareilly district forms a part of Ramganga sub-basin in the central Indo-Gangetic plain. The Ramganga river divides the district into two unequal parts. Topographically, the area is almost an open plain with slight undulations which are more pronounced in the southern parts where the ground surface is being dissected by numerous river valleys. In the area lying north of Ramganga river, the general slope of land surface is from north to south, and in south of Ramganga i.e. Aonla tehsil it is from west to east. The highest elevation of land surface above mean sea level, as recorded on the extreme northern border of the district, is 202 metres and the lowest as recorded in the south eastern part of Fatehganj is 158 metres. A number of elevated structures i.e. mounds have been observed in Shergarh, Faridpur and Aonla area. The gradient of slope at land surface generally varies between 0.65-1.00 metres per km throughout the area.

In general, the area shows the following distinctive geomorphic units as inferred from I.R.S. Imagery, Survey of India toposheet and selective field checks (Plate-V).

1. Lower piedmont plain of Tarai
2. Older alluvial plain or upland
3. Younger alluvial plain or low land
4. Meander flood plain

Soils:

According to the classification followed by the State soil survey organisation, the soil of the district, can be classified into three major groups, based on its texture and composition characteristics.

Bareilly Type-1 (Tarai soils)

Bareilly Type-2 (Khadar or low-land soils)

Bareilly Type-3 (Upland or Bangar soils)

Bareilly Type-1 (Tarai soils):

This type of soils are found in Tarai belt of Baheri tehsil and locally know as "Mar". The soil is characterised by fine texture, rich in organic matter, dark to grey in

colour and rich in clay contents, especially in upper layers, the lower layers being lighter in texture, they are calcareous in nature. These soils posses the capacity of retaining moisture for longer period.

Bareilly Type-2 (Khadar or low-land soils):

This type of soils is found in all tehsils in younger alluvial plain or low land along the river courses and are characterised by generally ash-grey to brownish-grey colour on the surface and their texture is silty loamy sand or sandy (the clay contents being low).

Bareilly Type-3 (Upland or Bangar soils):

These soils occur in upland tract of older alluvial plain. The soil profile is generally mature, showing good development. It can be sub-grouped depending upon its topographic occurrence and textural nature into sandy soil, clayey soils and loamy soil.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

The Gangetic alluvial plain occupies a structural trough infront of Himalayan ranges. It was interpreted to be a fore deep or great rift valley, filled with alluvium of enormous thickness varying from 4500 metres (Oldham 1917) to as much as 25 Km (Pascoe 1956). Bareilly district falls in one of such depression known as Ramganga depression. The area in Bareilly district occupies a small part of southern fringe of Tarai formation and flood plain deposits. These are underlain by quaternary sediments brought from Himalayas. The alluvial sediments mainly comprising clay, sand, gravel in varied proportion and grades are deposited is well stratified formation consisting of alternate bed of clay and granular material (sand fine to coarse) which is the main water bearings formation formed as aquifer.

The general geological sequence of formation in the district is as follows:

GEOLOGICAL SUCCESSION WITHIN BAREILLY

System	Age	Formation	Lithology
Quaternary	Recent to Upper Pliestocene	Lower Piedmont Plain (Tarai)	Clay-sandy, sand, gravel and clay
	Recent to Upper Pliestocene	Younger Alluvium	Fine sand, silt clay mixed with gravel
	Upper Pliestocene	Older Alluvium	Clay with kankar & sand

The district is underlain by a thick pile of alluvial sediments. The depth of basement in the area is not known so far as no borehole could reach upto the bedrock. The sub surface geological configuration of sediments has been studied with the help of lithological log / electrical log drilled by Central Ground Water Board. The board under its exploratory tubewell programme has drilled 11 boreholes.

The details of tubewells drilled so far are given in the Table-IV and state tubewells salient features are given in the Table-V.

Table-IV

SALIENT FEATURES OF EXPLORATORY TUBEWELL / DEPOSIT WELLS OF CGWB IN BAREILLY DISTRICT, U.P.

Sl. No.	Location	Year of construction	Depth drilled / Depth of tubewell (mbgl)	Granular zones encountered (mbgl)	Static water level (mbgl)	Discharge (lps) / Maximum drawdown (m)	Specific capacity (lps/m)	Storativity (S)	Transmissivity (m^2/day) / Hydraulic conductivity (m/day)
1.	Ponderi Halwa (Exploratory Well)								
(A)	Main well	1985	507.17 495 m.	279.00-291.00 300.00-309.00 312.00-315.00 327.00-339.00 345.00-357.00 372.00-378.00 402.00-414.00 432.00-444.00 450.00-459.00 472.00-487.00	3.65	68.33 21.68 after 10,000 minutes pumping 36.83	3.15	4.15×10E-4	1555.00 14.95
(B)	Observation well		 493 m.	288.00-291.00 303.00-309.00 312.00-315.00 327.00-339.00 348.00-354.00 372.00-378.00 405.00-411.00 438.00-444.00 456.00-459.00 418.00-487.00	-	 2.97	-	-	-

Sl. No.	Location	Year of construction	Depth drilled Depth of tubewell (mbgl)	Granular zones encountered (mbgl)	Static water level (mbgl)	Discharge (lps) Maximum drawdown (m)	Specific capacity (lps/m)	Storativity (S)	Transmissivity (m^2/day) Hydraulic conductivity (m/day)
(C)	Test well	1985	752.73 740.00	522.00-534.00 551.00-557.00 567.00-577.00 607.00-619.00 625.00-637.00 661.00-676.00 697.00-700.00 724.00-736.00	1.25	O.W. 1.30	-	-	-
2.	B.S.F. Camp Bhitora deposit well	1985	203.12 197.00	86.62-99.00 105.00-117.34 123.47-141.00 147.17-153.38 164.58-177.00 183.56-191.63	3.05	101.75 20.53 after 200 minutes of pumping	4.956	-	2683.00 25.55
3.	Nawabganj exploratory (A.E.C.P.)	2002	207.70 195.00	102.00-108.00 114.00-126.00 147.00-153.00 159.00-171.00 177.00-189.00	2.23	1627 lpm or 27.12 lps 5.39	302 lpm/m	1532.57	30^0C
4.	Fareedpur exploratory (A.E.C.P.)	2001	204.50 144.50	75.50-87.50 96.50-108.50 114.50-126.50 132.50-138.50	5.16	1608 lpm or 26.8 lps 2.04	788 lpm/m	2120 m^2/day	28^0C
5.	Model town exploratory (A.E.C.P.) (Bareilly town)	2002	204.55 135.00	51.00-63.00 69.00-81.00	9.28	2416 lpm or 40.26 lps	869 lpm/m	1447	29^0C

Sl. No.	Location	Year of construction	Depth drilled Depth of tubewell (mbgl)	Granular zones encountered (mbgl)	Static water level (mbgl)	Discharge (lps) Maximum drawdown (m)	Specific capacity (lps/m)	Storativity (S)	Transmissivity (m^2/day) Hydraulic conductivity (m/day)
				87.00-93.00 111.00-117.00 123.00-131.00		2.78			
6.	Suresh Sharma Nagar exploratory (A.E.C.P.) (Bareilly town)	2002	201.50 155.00	66.00-84.00 99.00-117.00 138.00-150.00	6.75	2187 lpm or 36.45 lps	2.58	1985	27^0C
7.	Gandhi Udhyan Exploratory (A.E.C.P.) (Bareilly town)	2002	451.37 255.00	117.00-126.00 132.00-144.00 180.00-192.00 201.00-207.00 222.00-228.00 243.00-249.00	8.45	1832 2.50	732.8 lpm	-	2811
8.	Baheri exploratory well	2001	451.00 238.00	164.00-176.00 182.00-200.00 220.00-232.00	-	2800 3.66	480	-	-
9.	Pachomi slimhole	1988	750 -	Data not available	-	-	-	-	-

Table-V

SALIENT FEATURES OF SELECTED STATE TUBEWELLS IN BAREILLY DISTRICT, U.P.

Location	Block / Tehsil	Year of construction	Depth drilled / Depth of t/w (mbgl)	Granular zones tapped (mbgl)	Static water level (mbgl)	Discharge (lps)	Drawdown (m)
						Maximum	*Recommended*
Baheri	Baheri	1975	143.26	39.05-42.14	3.0	51.5	35.36
	Baheri		130.68	55.17-57.63 99.37-103.4 107.90-110.98 119.18-129.26		5.63	3.00
Shishgarh	Shergarh	1978	105.21	28.74-47.21	3.0	96	37.90
	Baheri		80.88	53.31-78.81		9.15	2.5
Shergarh	Shergarh	1977	97.53	41.54-60.71			
	Baheri		90.81	67.96-89.31			
Nawabganj	Nawabganj	1975	105.61	32.40-41.16	3.0	45.71	30.31
	Nawabganj		94.89	66.10-78.86 86.20-93.89		7.04	3.05
Mirganj	Mirganj	1973	91.74	30.29-75.03	4.3	26.33	26.33
	Mirganj	1978	76.50			1.83	1.83
Fatehgarh west	Fatehgarh west	1981	71.64	28.42-41.78	4.27	39.35	30.31
			65.82	47.57-64.54		-	4.00
	Mirganj						
Rihtora (T/W-2)	Birthi Chainpur	1981	80.79	26.81-38.43	3.05	34.40	25.00
			74.40	46.13-56.05 67.28-72.88		2.10	1.83
	Bareilly						
Jhagbazpur	Ramnagar	1972	96.01	34.90-37.82	7.62	51.60	-
	Aonla		92.81	43.84-65.76 69.11-91.41		2.74	
Sisauna	Majhgawan	1981	86.87	38.38-69.34	4.88	64.78	-
	Aonla		84.96	73.99-83.38		2.79	-
Bareilly cantonment (TW-22 MES)	Birthi chainpur	1983	121.92	33.83-51.21	4.88	61.00	-
			115.21	55.70-60.35 64.62-79.25 109.73-112.78		2.75	
	Bareilly						
Rawal Kalan	Bhutah	1979	88.39	33.15-60.81	-	54.59	-
	Faridpur		86.64	68.68-84.71		3.48	
Rasula	Alampur	1968	106.68	34.39-35.66	-	-	-
	Aonla		90.00	56.87-87.20			
Dalpatpur	Alampur	1967	100.58	41.10-54.84	-	-	-
	Aonla		94.00	68.71-85.34 88.21-90.98			
Faridpur	Faridpur	1977	85.34	36.65-78.54	4.2	54.75	37.90
	Faridpur		80.24			4.00	3.0

As per above Table-IV and V it has been established that by and large, four major group of granular zones occur down to 750 meters depth below ground level. These granular zones having tremendous capacity of storing water are given below:

Ist Aquifer Group	00.00-219.00 mbgl	Phreatic aquifer (Fine to coarse sand with clay)
IInd Aquifer Group	219.00-230.00-300.00	Confined aquifer (Fine to medium sand sometime mixed with clay)
IIIrd Aquifer Group	300.00-510.00	Confined aquifer (Fine to medium sand, predominantly fine sand)
IVth Aquifer Group	510.00-750.00	Confined aquifer (Dominated with fine sand & little clay)

DEPTH TO WATER LEVEL:

Depth to water level of topmost ground water saturated surface is unconfined aquifer. To study the ground water regime & its behaviour in the district during premonsoon (June, 2007) and postmonsoon (Nov, 2007). The water level and fluctuation data of permanent hydrograph stations of CGWB and State Ground Water Department, U.P., have been analysed and summerised below.

From the depth to water level map Plate-II it is indicated that in general water level in Bareilly district varies between 0 and 7 mbgl. However, in the southwestern parts deeper water levels upto 15 mbgl or more are observed. Along the Ramganga river water levels are shallower and within 5 mbgl.

BLOCKWISE WATER LEVEL DATA (PRE AND POST) AND WATER LEVEL FLUCTUATION FOR THE YEAR 2007

Sl. No.	Blocks	Water level range premonsoon (mbgl)	Water level range postmonsoon (mbgl)	Average Fluctuation (m)
1.	Bithvi chainpur	3.53-5.89	3.20-5.15	+0.49
2.	Kyara	3.18-6.92	2.61-5.55	+2.49
3.	Bhuta	3.94-7.20	1.95-5.77	+2.20
4.	Faridpur	3.20-8.65	3.05-8.17	+0.39
5.	Kaira	5.92-7.08	3.75-5.55	+3.31 (data 2008)

Sl. No.	Blocks	Water level range premonsoon (mbgl)	Water level range postmonsoon (mbgl)	Average Fluctuation (m)
6.	Baheri	2.45-4.49	1.39-3.19	+0.98
7.	Richha	3.78-5.00	3.00-4.01	+0.89
8.	Bhadpura	2.50-2.93	0.94-1.12	+1.39
9.	Nawabganj	3.45-4.26	2.70-2.90	+1.20
10.	Shergarh	4.82-6.62	2.70-5.30	+1.38
11.	Bhojipura	3.25-4.05	2.94-3.00	+1.10
12.	Mirganj	4.47-6.70	3.30-5.15	+1.40
13.	Alampur Zafrabad	5.68-11.64	5.48-10.95	+0.50
14.	Ram Nagar	6.08-14.88	5.88-14.65	+0.34
15.	Majhgawan	5.00-6.32	4.45-6.10	+0.21

The analysis of water level data from hydrograph stations established by CGWB in the district, reflect a declining trend from 1998 to 2007 at 4 stations from 4 to 34 cm/yr. Whereas rising trend is observed at 6 stations. Whereas, during postmonsoon period 7 out of 10 stations show a declining trends from 9 to 28 cm/yr. Nawabganj station shows maximum rising trend.

4.2 GROUND WATER RESOURCE:

Bareilly district being close to the Himalayas has tremendous water resource to be utilised for its agriculture needs. Ground water, due to its assured and timely supply has now become the most dependable source for irrigation but its over exploitation adversely affect its regime for a better ground water management it is necessary to have a constant vigil on its overall reserve and status of utilisation. The blockwise annual ground water recharge, its present withdrawal and available balance for future utilisation (For the year 2004 to 2009) has been computed as per recommended methodology of GEC-1997 with the consultation of U.P Govt. The blockwise ground water resource is given below in Table-VI.

Table-VI

DYNAMIC GROUND WATER RESOURCES OF BAREILLY, U.P.
(As on 31.03.2004)

Sl. No.	Assessment units blocks	Annual ground water recharge (in ham)	Net annual ground water availability (in ham)	Existing gross ground water draft for all uses (in ham)	Net ground water availability for future irrigation development (in ham)	Stage of ground water development (in %)	Category of block
1.	Alampur Zafrabad	5752.79	5177.51	5649.36	-681.08	109.11	Over exploited
2.	Baheri	13231.33	11908.19	6940.81	4710.32	58.29	Safe
3.	Bhadpura	6257.25	5944.39	5885.44	-159.03	99.01	Semi critical
4.	Bhojipura	5918.18	5622.27	4973.36	528.02	88.46	Safe
5.	Bhutah	9600.08	9120.08	8903.09	-112.75	97.62	Semi critical
6.	Bithrichainpur	6290.65	5661.58	4330.94	1170.24	76.50	Safe
7.	Faridpur	10008.33	9507.91	8338.05	971.33	87.70	Safe
8.	Fatehganj (W)	6492.72	6168.08	6002.41	22.76	97.31	Semi critical
9.	Kiyara	3736.05	3362.44	3277.85	-40.51	97.48	Semi critical
10.	Majhgawn	6237.22	5613.50	5043.81	449.60	89.85	Safe
11.	Meerganj	6955.48	6259.93	6199.96	-169.66	99.04	Critical
12.	Nawabganj	9092.08	8182.87	8174.65	-188.91	99.90	Semi critical
13.	Ram Nagar	5751.07	5175.97	4804.73	193.29	92.83	Semi critical
14.	Richha	9115.23	8203.70	4590.08	3443.62	55.95	Safe
15.	Shergarh	8249.86	7424.87	7064.61	98.61	95.15	Semi critical
	Total	**112688.31**	**103333.31**	**90179.15**	**10235.83**	**87.27**	

As per above Table-VI the block Alampur Jafarabad is over exploited (109.11%), Meerganj is under critical category (99.04%) and out of remaining 7 blocks are categorised as semi critical and 6 blocks as safe.

4.3 GROUND WATER QUALITY:

The ground water in phreatic aquifer (dugwell / shallow tubewell zone) in general is colourless, odourless and slightly alkaline in nature. The specific electrical conductance in phreatic zone water ranges from 350-1610 μs/cm at 25^0C. Conductance below 750 μs/cm at 25^0C has been observed in 63% of analysed water samples.

It is observed that the ground water is suitable for drinking and domestic use in respect to all constituents except Nitrate. The high concentration of Nitrate is found in Bhojipura (205 mg/l) and Ranman area (125 mg/l) the value of Nitrate ranges from nd to 205 mg/l. The high content of Nitrate is due to use of excess fertilizers in agriculture fields and improper waste disposal. The Arsenic content ranges from 0.001 to 0.034 ppm (Dhanali east) in the ground water of the district.

4.4 STATUS OF GROUND WATER DEVELOPMENT (BLOCKWISE):

The present level of ground water development in the district is 87.2%, leaving its balance of 10235.83 ham for further development which may create additional irrigation facilities considering 85% of total balance in the safe blocks only. A blockwise further ground water development plan has been worked out is given below (Table-VII & Plate-VI)

Table-VII

BLOCKWISE PROPOSAL OF GROUND WATER DEVELOPMENT FOR IRRIGATION PURPOSE DISTRICT BAREILLY, U.P.

Sl. No.	Blocks	G.W. balance (Ham)	G.W. available for irrigation (ham) 85% of Col.3	G.W. proposed to be utilised for development (ham) 70% of Col.4	Proposed Structure			Additional Irrigation potential will be created (ha) (Average depth of irrigation water adopted 0.50 m	Category	Stage of development (%)	Remark
					Mod. to deep tubewell upto 200 m depth 40% of Col.5 & U.D. (12 ham)	*Shallow T/W upto 100 m 30% of Col.5 & U.D. (2.2 ham)*	*Shallow boring upto 60 m depth 30% of Col.5 & U.D. (1.2 ham)*				
1	*2*	*3*	*4*	*5*		*6*	*7*	*8*	*9*	*10*	*11*
1.	Alampur Zafrabad	-681.08	-	-	-	-	-	-	Over exp.	109.11	Artificial recharge & rainwater harvesting is required
2.	Baheri	4710.32	4003.77	2802.64	93.42	3.85	700.66	5605.28	Safe	58.29	-
3.	Bhadpura	-159.03	-	-	-	-	-	-	Semi critical	99.01	Require artificial recharge & rain water harvesting in the area
4.	Bhojipura	528.02	448.81	314.17	10.47	42.84	78.54	628.34	Safe	88.46	-
5.	Bhutah	-112.75	-	-	-	-	-	-	Semi critical	97.62	Required artificial recharge & rain water harvesting in the area
6.	Bithrichainpur	1170.24	994.70	696.29	23.20	94.94	174.07	1392.58	Safe	76.50	-
7.	Faridpur	971.33	825.63	577.94	19.26	7.88	144.48	1155.88	Safe	87.70	-
8.	Fatehganj (W)	22.76	19.34	13.50	0.45	1.84	3.37	27.00	Semi critical	97.31	Required artificial recharge & rain water harvesting
9.	Kiyara	-40.51	-	-	-	-	-	-	Do	97.48	Do

Sl. No.	Blocks	G.W. balance (Ham)	G.W. available for irrigation (ham) 85% of Col.3	G.W. proposed to be utilised for development (ham) 70% of Col.4	Proposed Structure			Additional Irrigation potential will be created (ha) (Average depth of irrigation water adopted 0.50 m	Category	Stage of development (%)	Remark
					Mod. to deep tubewell upto 200 m depth 40% of Col.5 & U.D. (12 ham)	*Shallow T/W upto 100 m 30% of Col.5 & U.D. (2.2 ham)*	*Shallow boring upto 60 m depth 30% of Col.5 & U.D. (1.2 ham)*				
1	*2*	*3*	*4*	*5*		*6*	*7*	*8*	*9*	*10*	*11*
10.	Majhgawn	449.60	382.16	267.51	8.91	36.47	66.87	535.02	Safe	89.85	Do
11.	Meerganj	-169.66	-	-	-	-	-	-	Critical	99.04	Do
12.	Nawabganj	-188.91	-	-	-	-	-	-	Semi critical	99.90	Do
13.	Ram Nagar	193.29	-	-	-	-	-	-	Semi critical	92.83	Do
14.	Richha	3443.62	2927.07	2048.94	68.29	279.40	512.23	6887.24	Safe	55.95	-
15.	Shergarh	98.61	-	-	-	-	-	-	Semi critical	95.15	Required artificial recharge & rain water harvesting

U.D. : Unit Draft

As per above table the ground water situation in the district is alarming, except in Baheri and Riccha blocks, where ground water development is upto 60%. The remaining 13 blocks shows the ground water development from 88 to more than 100%, where further development of ground water is not advisable.

The ground water situation in the district and salient feature is given below:

Table-VIII

Geological formation in the entire district	Well feasible	Rig suitable	Depth of wells T/W (m)	Discharge (lpm)	Type of pump water lifting device	Drinking water wells & supply on ground water
Soft Rock (Alluvium) sand fine to medium with gravel and clay	Dugwells	Mannual	10 to 25	As per water lifting device	Rope & Bucket P. wheel Dhekali	Drinking water in use.
	Hand pump IndiamarkII	Hand boring or by rotary, reverse rig	25 to 35	50 to 100	Manual or Jet Pump	Drinking water
	Shallow Tubewell	Manual boring set or by rotary / reverse rig	30-100	800-2000	Electric motor, pumpset diesel submersible motor	Irrigation & drinking water
	Deep tubewell	Direct rotary rig	More than 200 mt.	2000-3000	Electric motor set submersible pump	do

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

As per ground water resource available in the district (Table-VI). The Riccha, Baheri, Bhojipura, Bithrichainpur, Faridpur and Kiyara blocks fall in the 'Safe' category, where ground water development stage is upto 89%. The remaining blocks are categorised as semi critical to over exploited, where further development of ground water should be regulated or restricted. However, deeper tubewells below 200m may be constructed tapping deeper aquifers.

5.2 WATER CONSERVATION & ARTIFICIAL RECHARGE:

The Alampur Zafrabad block is categorised as over exploited block where artificial recharge structures and rain water harvesting schemes are to be implemented using surplus rain water. The technical guidance regarding artificial &rain water harvesting schems is provided by Central Ground Water Board as and when required.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

The long term water level data during postmonsoon period is indicating a declining trend of 7 monitored stations. Hence, one of the major uses is of declining trends which need to be tackled. The high concentration of Nitrate is found in Bhojipura (205 mg/l) and Kanman area (125 mg/l) and Arsenic content ranges from 0.001 ppm (at Ram Nagar) and 0.034 ppm (at village Dhanali Punvi). There is no salinity problem in the district.

7.0 AWARENESS AND TRAINING ACTIVITY

7.1 MASS AWARENESS PROGRAMME (MAP) AND WATER MANAGEMENT TRAINING PROGRAMME (WMTP) BY CGWB:

Three mass awareness programmes have been carried out by Central Ground Water Board in Bareilly district; at Shyamganj, Bareilly, CGWB, division-XVI office and at Civil Lines in Bareilly.

7.2 PARTICIPATION IN EXHIBITION, MELA, FAIR ETC.:

No such programme was conducted in the district.

7.3 PRESENTATION AND LECTURE DELIVERED IN PUBLIC FORUM / RADIO / TV / INSTITUTION OF REPUTE / GRASS ROOT ASSOCIATIONS / NGO / ACADEMIC INSTITUTION ETC.:

Time to time the programme on water broadcasted by television and radio through national & regional agencies of Government of India.

8.0 AREA NOTIFIED BY CGWA / SGWA

Nil.

9.0 RECOMMENDATIONS

(a) Since long term water level data are indicating a very slight rising trend in the entire district except Fatehganj west and Alampur Jafrabad indicating negative trend. A regular monitoring of water level at close interval, through suitably located structure is essential.

(b) The permanent structures i.e. piezometers down to the depth at 50 mbgl, should be constructed in the entire district as presently the dug wells area not in use and not giving the representative data of water level.

(c) More exploratory tubewell should be constructed in the Aonla tehsil and northern part of district to determine the potentialities of II & III Aquifer groups.

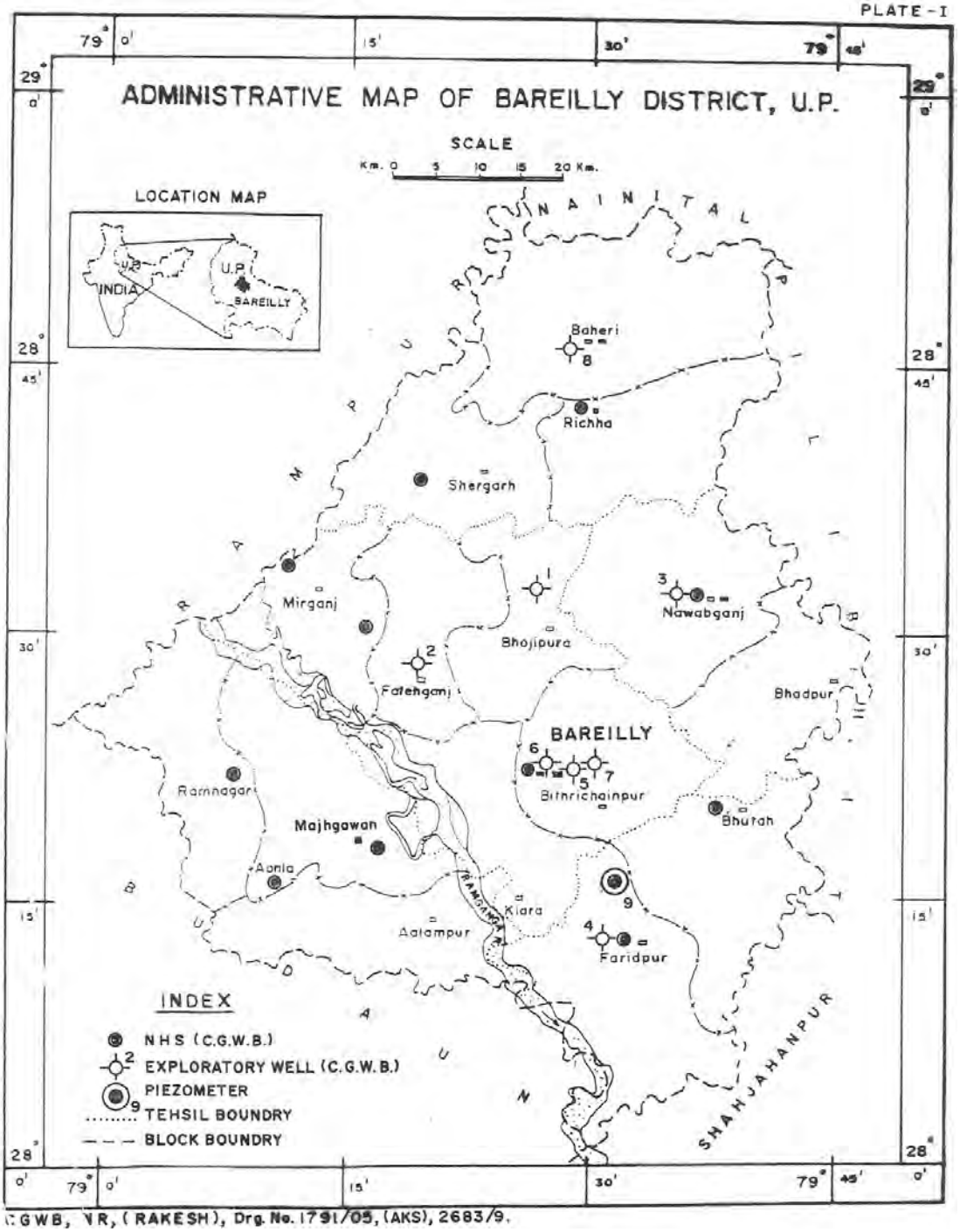
(d) All the existing tubewells in the district are generally tapping the upper parts of Ist Aquifer group down to maximum depth of 150 meters below ground level. It is suggested that in future the deeper state tubewells should be designed to tap lower parts of Ist Aquifer group (i.e. below 150 mbgl depth) and if economically feasible, II and III Aquifer group should be tapped for industries and domestic water supply.

(e) In Fatehganj west, Alampur Jafrabad & Meerganj blocks which fall under semi-critical to critical category, only need base development of ground water may be considered to a very limited extent. Construction of artificial recharge structures and rain water harvesting should be made compulsory in the

government building like school, blocks & private school to maintain the water levels.

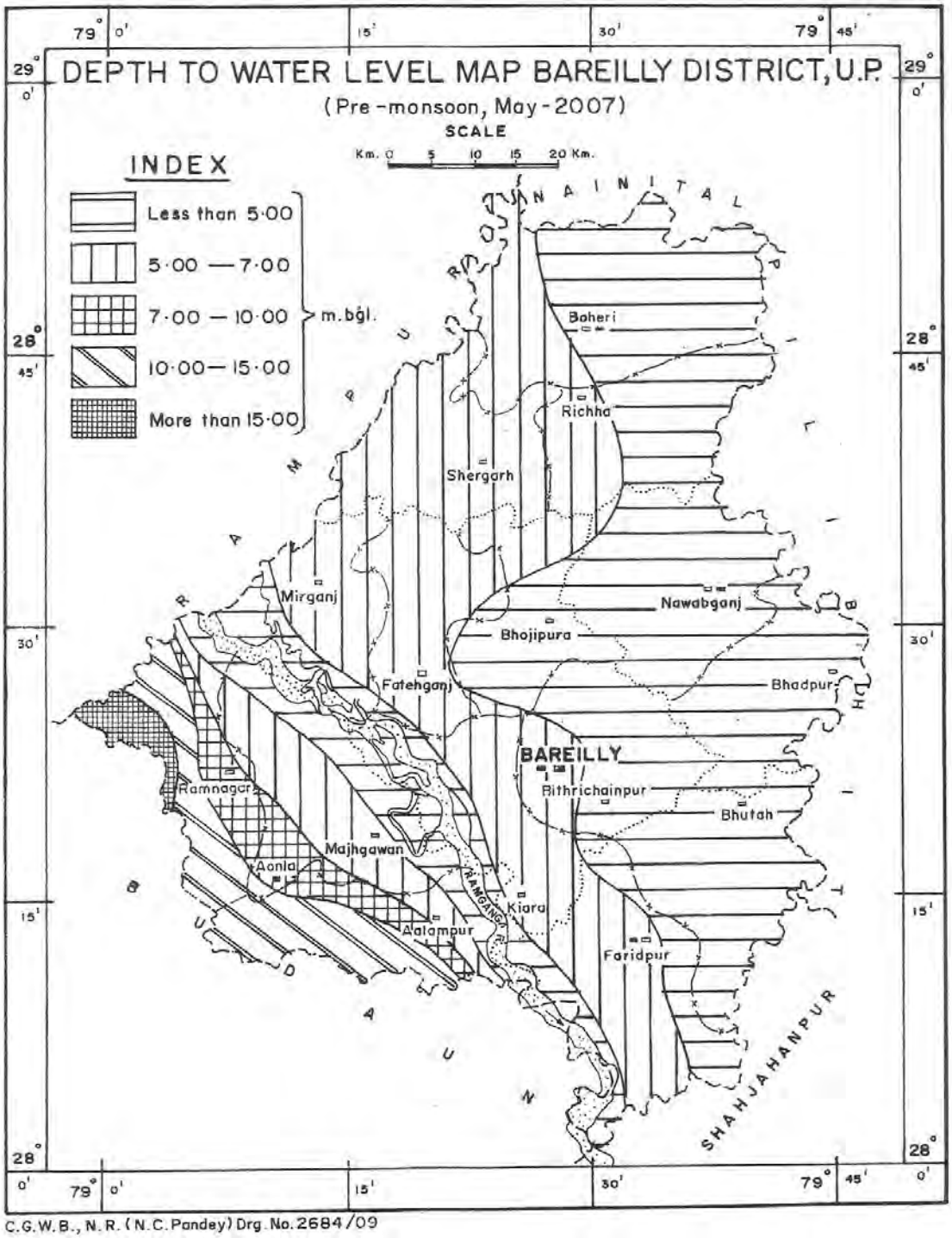
(f) The barren land which is unsuitable for agriculture should be brought to afforestation scheme to maintain the ecological balance of the area, which may help in the development of ground water regime as well. Water conservation / recharge structures such as check dams etc. should be constructed at suitable locations.

PLATE - I



CGWB, NR, (RAKESH), Drg. No. 1791/05, (AKS), 2683/9.

PLATE-II



C.G.W.B., N.R. (N.C. Pandey) Drg. No. 2684/09

PLATE - III

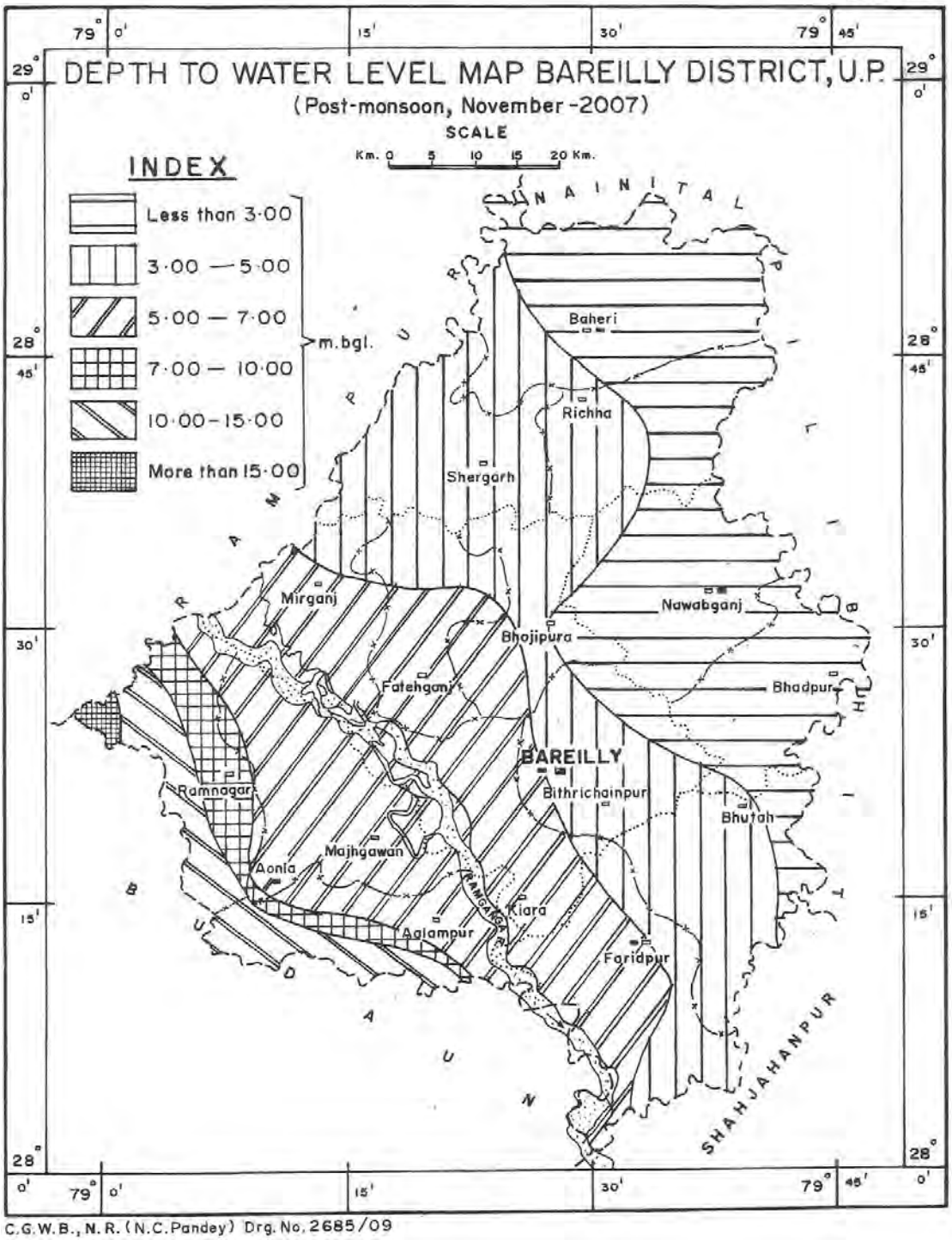


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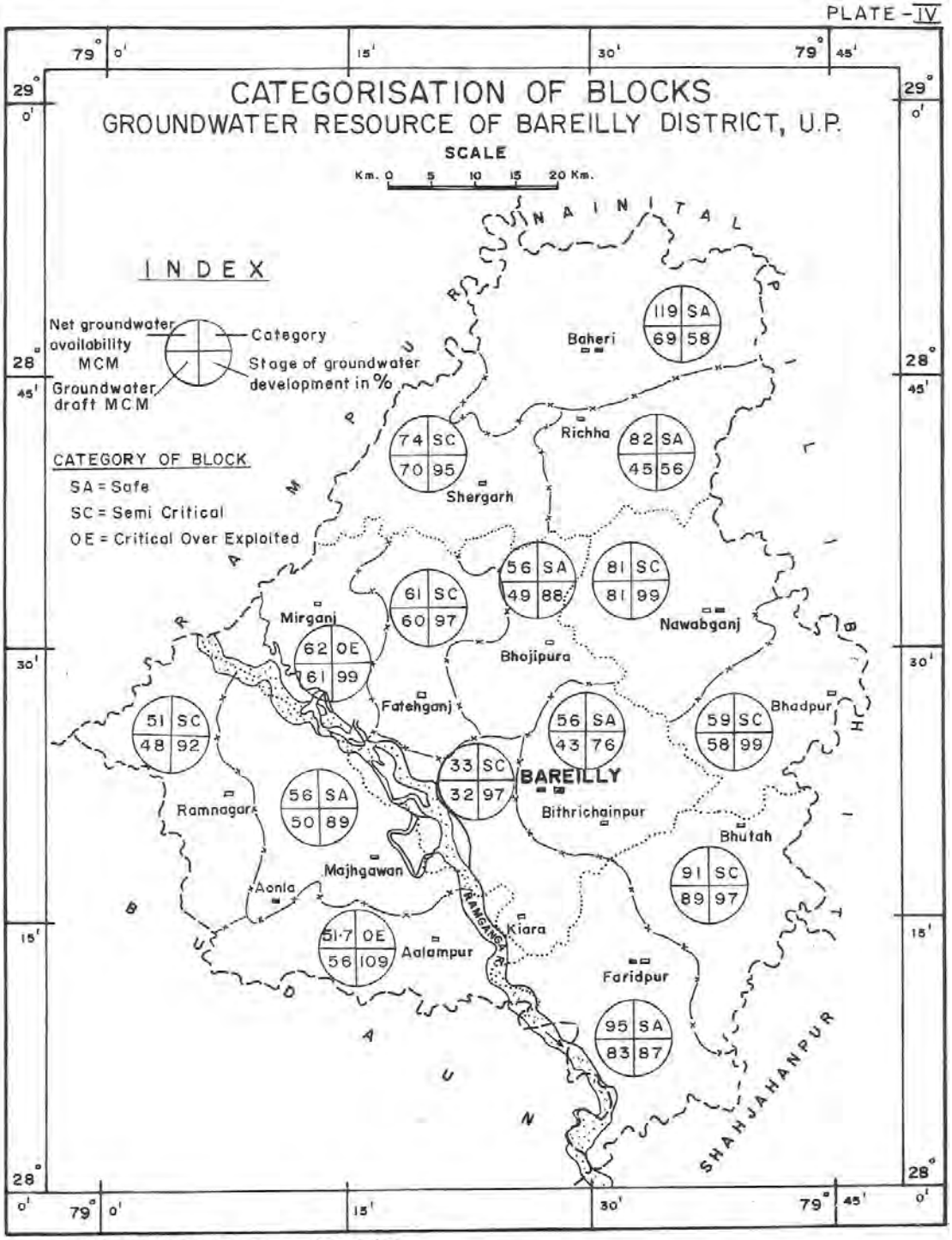
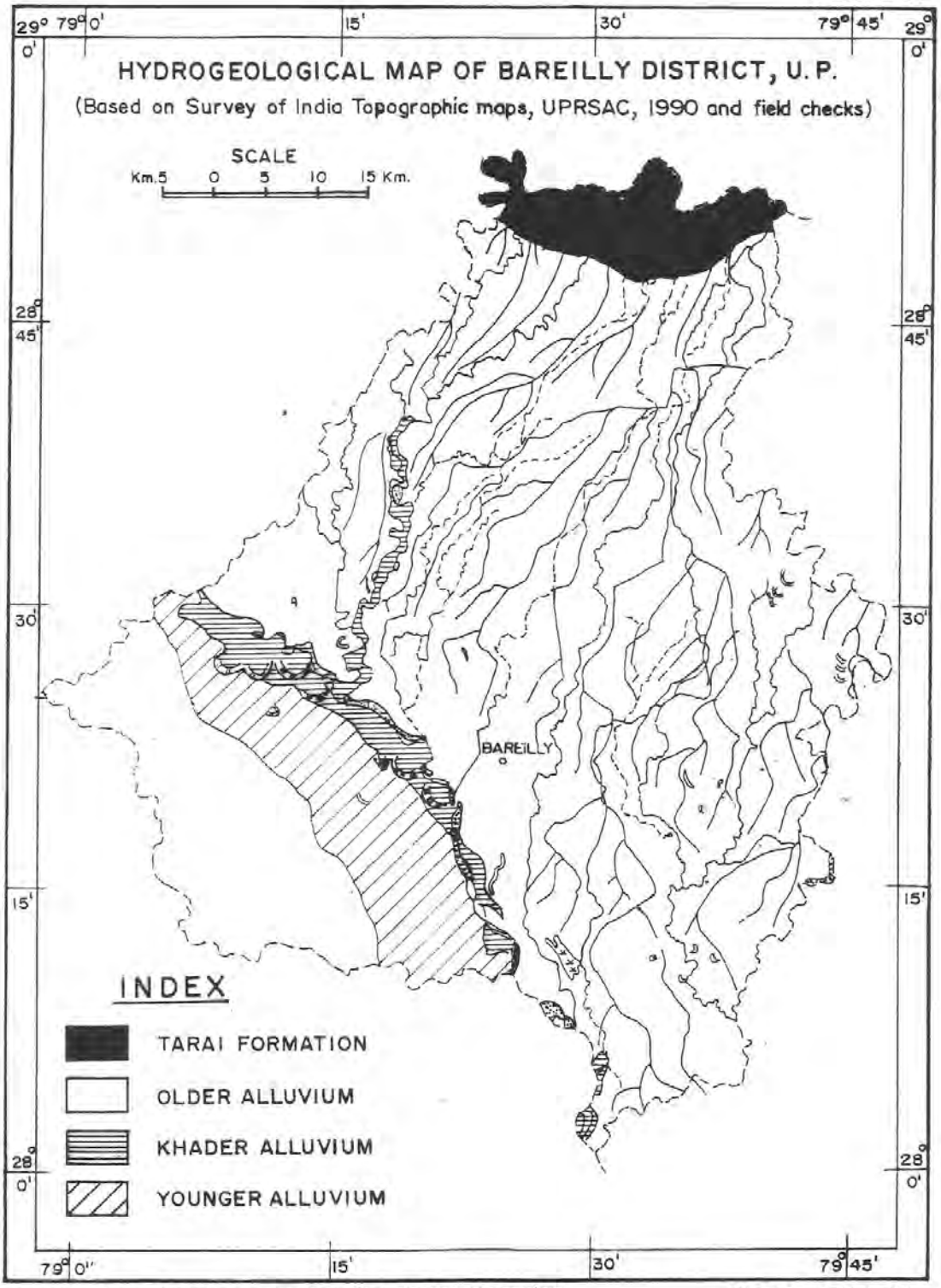
PLATE - IV



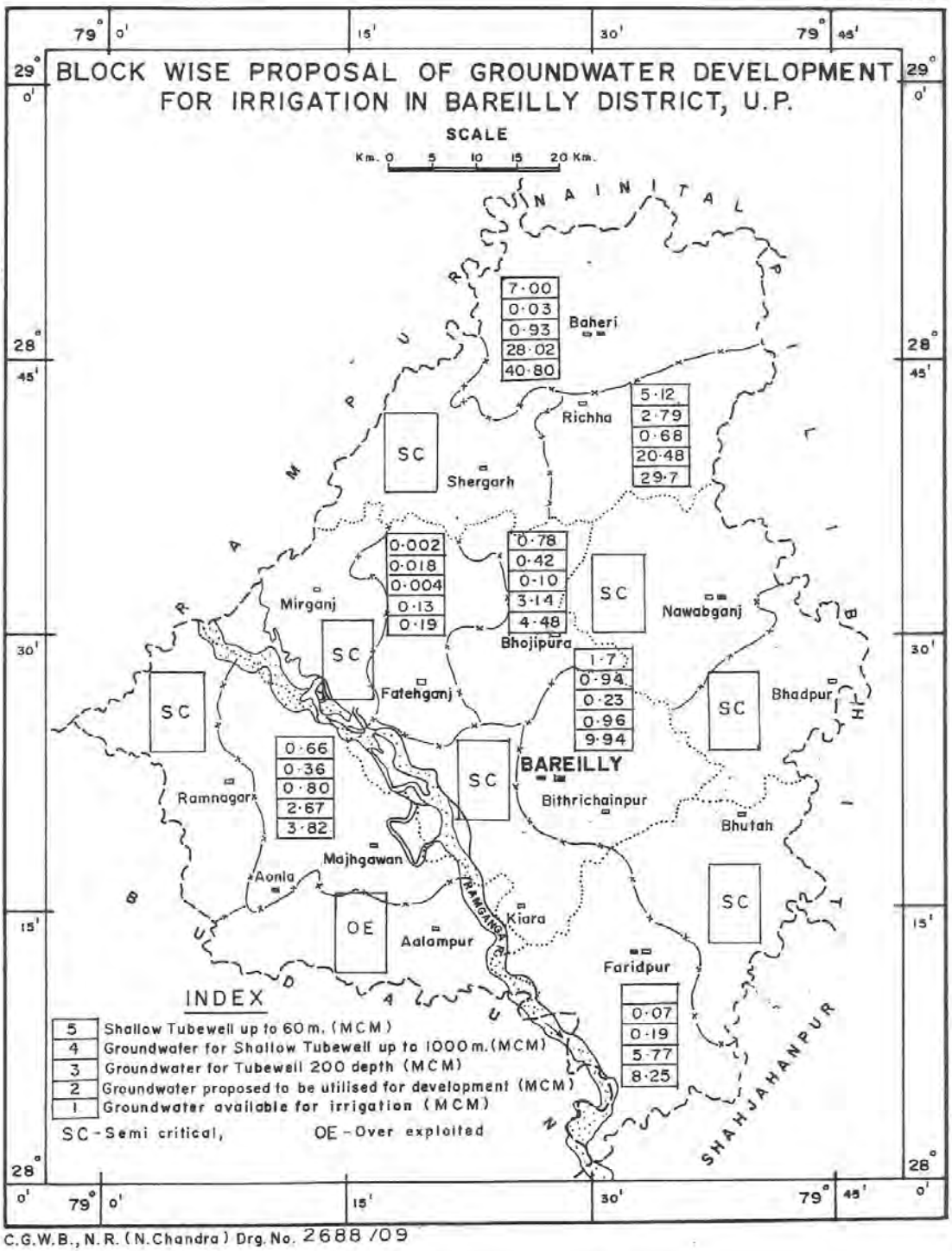
CGWB, NR, (RAKESH), Drg. No. 2686/09

PLATE-V



C. G. W. B., N.R., (AKS), Drg. no. 1793/05., (AKS), 2687/09. After Dr. B. C. Joshi

PLATE - VI



C.G.W.B., N.R. (N.Chandra) Drg. No. 2688 /09