

**DISTRICT GROUND WATER BROCHURE OF BAGHPAT
DISTRICT, U.P.**

(A.A.P.: 2013-2014)

By

Sanjeev Mehrotra

Scientist 'C'

CONTENTS

Chapter	Title	Page No.
	BAGHPAT DISTRICT AT A GLANCE	.....3
1.0	INTRODUCTION	.....6
2.0	CLIMATE & RAINFALL	.....6
3.0	GEOMORPHOLOGY & SOIL TYPE	.....9
4.0	GROUND WATER SCENARIO	.....10
	4.1 Hydrogeology	
	4.2 Depth to water level	
	4.3 Long Term Water Level Trend	
	4.4 Ground Water Resource	
	4.5 Ground Water Quality	
	4.6 Status of Ground Water Development (Blockwise)	
5.0	GROUND WATER MANAGEMENT STRATEGY	.....20
	5.1 Ground Water Development	
	5.2 Water Conservation Structure & Artificial Recharge	
6.0	GROUND WATER RELATED ISSUES AND PROBLEMS	.....21
7.0	AWARENESS & TRAINING ACTIVITY	.....21
	7.1 Mass Awareness Programme (MAP) & Water Management Training Programmed (WMTP) by CGWB	

7.2 Participation in Exhibition, Mela, Fair etc.

7.3 Presentation and Lectures delivered in Public Forum/
Radio / T.V. / Institute of Repute / Grassroots association /
NGO / Academic Institution etc.

VIII	AREA NOTIFIED BY CGWB / SGWA	.....22
IX	RECOMMENDATIONS	.....22

PLATES:

- I. INDEX MAP - BAGHPAT DISTRICT, U.P.
- II. PRE-MONSOON DEPTH TO WATER LEVEL MAP - BAGHPAT DISTRICT, U.P. (MAY, 2012)
- III. POST-MONSOON DEPTH TO WATER LEVEL MAP - BAGHPAT DISTRICT, U.P. (NOV. 2012)
- IV. HYDROGEOLOGICAL MAP – BAGHPAT DISTRICT
- V. CATEGORIZATION OF BLOCKS SHOWING GROUND WATER RESOURCES / DRAFT ETC.

BAGHPAT DISTRICT AT GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 1321
ii. Administrative Divisions (as on 31.03.2012)	
Number of Tehsil/Block:	: 3/6
Number of Villages habitated/non habitated	: 290/25
iii. Population (as on 2001 census)	: 11,63,991
iv. Average Annual Rainfall (mm) (2004-12)	: 585.3

2. GEOMORPHOLOGY

Major Physiographic Units	: Three: 1. Older alluvium 2. Older flood plain 3. Active flood plain
Major Drainages	: Yamuna, Hindon & its tributaries

3. LAND USE (Sq. Km.)

a) Forest area	: 15.25
b) Net area sown	: 1091.36
c) Gross area sown	: 1746.56

4. MAJOR SOIL TYPES

: Bhur, Matiyar, Domat or Loam

5. AREA UNDER PRINCIPAL CROPS (as on 31.03.2012) : 133541 ha – wheat, sugar cane & paddy

6. IRRIGATION BY DIFFERENT SOURCES

(Area (ha)/ Number of Structures)

Dugwells	: 345 ha / 79 Nos.
Tubewells/Borewells	: 102312 ha / 26774 Nos.
Tanks/ponds	: Nil
Canals	: 3256 ha / 435 Km
Other Sources	: 0 ha
Net Irrigated Area	: 105913 ha
Gross Irrigated Area	: 174653 ha

7. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2013)

No. of Dugwells	:	Nil
No. of Piezometers	:	1
8. PREDOMINANT GEOLOGICAL FORMATIONS	:	Alluvium comprising of sand of various grades
9. HYDROGEOLOGY		
Major water bearing formation	:	Sand, medium grained
(Pre-monsoon Depth to water level during 2012)	:	Max. 32.03 mbgl (Pusar, bock Binali) Min 4.71 mbgl (Shahpur Bidauli, bock Baraut)
(Post-monsoon Depth to water level during 2012)	:	Max. 32.08 mbgl (Pusar, bock Binali) Min 4.72 mbgl (Shahpur Bidauli, bock Baraut)
Average Long term water level trend in 10 years (2001-2010) in m/yr <i>(Based on GWD data as no sufficient data is available with CGWB)</i>	:	Premonsoon (-) 0.62 m/yr (Chhaprauli block) to (-) 1.55 m/yr (Pilana block) Postmonsoon (-) 0.43 m/yr (Binauli block) to (-) 1.44 m/yr (Pilana block)
10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2013)		
No of wells drilled (EW, OW, PZ, SH, Total)	:	EW-7, PZ-3, Total-10
Depth range (mbgl)	:	202 (Malakpur EW) – 456 (Daha EW)
Discharge (lps)	:	23 (Mitali EW) – 54 (Malakpur EW)
Storativity (S)	:	7.75×10^{-4} (Johari EW) to 2.05×10^{-3} (Malakpur EW)
Transmissivity (m^2/day)	:	345 (Mitali EW) to 1712 (Aminagar Sarai EW)

11. GROUND WATER QUALITY

Presence of Chemical constituents more than permissible : Fluoride 1.85 mg/l at
limit (e.g. EC, F, As, Fe) Baraut block H/P

12. DYNAMIC GROUND WATER RESOURCES (As on 31-3-2009) in Ha.m

Annual Replenishable Ground Water Resources : 37838.95

Net Annual Ground Water Draft : 44125.07

Projected Demand for Domestic and Industrial Uses upto 2025 : 330.98

Stage of Ground Water Development : 116.61%

13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programmes organized : One

Date : 30.5.1999

Place : Tikri, Daha, Nirpura
Changama villages,
block Binauli

No. of participants : 300

Water Management Training Programme organized : NIL

Date

Place

No. of participants

14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING : 1. Garh Kangran (Daha)
2. Azampur Musam
block Binauli

Projects completed by CGWB (No.) : 2

Projects under technical guidance of CGWB (Numbers) : Nil

15. GROUND WATER CONTROL AND REGULATION :

Number of OE Blocks : Five:
1. Binauli 2. Pilana 3.
Chaprauli 4. Bagpat 5.
Khekra

No of Semi Critical Blocks : One:
1. Baraut

No of blocks notified : Nil

16. MAJOR GROUND WATER PROBLEMS AND ISSUES : Declining ground water
level trend

GROUND WATER BROCHURE OF DISTRICT BAGHPAT, U.P.

(A.A.P.: 2013-2014)

By

Sanjeev Mehrotra

Scientist 'C'

1.0 INTRODUCTION

District Baghpat, a western district of the state of Uttar Pradesh lies between latitude 28° 47' 00" and 29° 18' 00" north and longitude 77° 07' 30" and 77° 30' 00" east and forms a part of Yamuna Hindon doab covering an area of 1321 sq.km. The district is administratively divided into three tehsil and is further divided into six development blocks. The total population as per 2001 census is 11,63,991. The population density is 881 per sq.km with 10.95 percent decadal increment in population.

The district of Baghpat is drained by river Yamuna and Hindon with their tributaries namely Krishna, Daula Budhera, Tora, Kandhal etc.

The irrigation in major part of the district is by means of minor irrigation structures such as tubewells, cavity wells and surface irrigation system i.e. Canals. Eastern Yamuna canal and its tributaries irrigate western part of the district. Block Binauli has least surface irrigation facilities. In the district only 3256 ha. (constituting 3.07% of net irrigated area of 105913 ha is irrigated by means of canals and 102312 ha. (96.60%) is irrigated by ground water.

Central Ground Water Board (CGWB) has constructed 8- exploratory wells to determine aquifer parameters, decipher subsurface aquifer geometry and ascertain quality of subsurface water in the district. CGWB has also constructed 3 numbers of piezometers to monitor the depth to water level, out of which only one is presently functional.

2.0 CLIMATE & RAINFALL

The average annual rainfall is 585.3 mm. The climate is sub-humid and it is characterised by dryness of the air with an intensely hot summer and a cold winter. About 90% of rainfall takes place from June to September. During monsoon surplus water is available for deep percolation to ground water.

There is a meteorological observatory at Meerut, the records of which may be taken as representative for meteorological condition. May is the hottest month with mean daily maximum temperature at 40⁰C and mean daily minimum temperature at 24.8⁰C. The maximum temperature may be as high as 46⁰C. With the onset of the monsoon there is an appreciable drop in day temperature. January is the coldest month with mean daily maximum temperature at 20.6⁰C and mean daily minimum temperature at 7.9⁰C. The air is dry during the greater part of the year and April & May are usually the driest month. The mean monthly morning relative humidity is 67%. Winds are generally light in post-monsoon and winter months. They are stronger in the summer and the monsoon months. The average wind velocity is 6.7 k.m.p.h. The potential evapotranspiration is 1545.3 mm.

Average annual rainfall for 2004-12 period is 585.3 mm and normal annual rainfall for the period 1901-1970 is 615.4 mm. The climatological and rainfall data pertaining to the district is presented below as table 1 & 2.

CLIMATOLOGICAL DATA OF MEERUT OBSERVATORY (1951-80)

Table-1

TEMP IN DIGREE CENTIGRATE	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total/Average
MAX.	21.6	24.4	30.1	36.3	39.7	39.2	34.2	32.7	33.6	32.8	28.6	23.6	31.4
MIN.	6.8	9.2	14.1	19.9	24.1	26.5	25.7	25	23.4	18	11.4	7.2	17.6
AVERAGE	14.2	16.8	22.1	28.1	31.9	32.85	29.95	28.85	28.5	25.4	20	15.4	24.5
RELATIVE HUMIDITY(%)MORNING	79	70	59	42	41	58	80	84	77	68	67	75	66.7
RELATIVE HUMIDITY(%)EVENING	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AVERAGE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MONTHLY RAINFALL(mm)	24.6	18.5	10.3	5.1	15	54	248	332.2	138.9	42.8	3.1	8.5	901
P.E.VALUE	1.519	0.997	0.432	0.165	0.496	2.011	11.777	16.783	6.43	1.898	0.122	0.444	43.074
POTENTIAL EVAPOTRANSPIRATION(mm)	53.1	75.1	127.1	174.7	222.2	225.3	163	142.1	142.2	111.3	65.9	43.3	1545.3
WIND SPEED IN KMPH	5.7	8	7.7	7.9	8.3	9.2	7.1	6.6	5.9	4.4	4.5	4.5	6.7
NO. OF RAINY DAYS	2	1.4	1.2	0.5	1.5	3	9.1	11.3	4.9	1.6	0.3	0.6	37.4

MONTHLY AND ANNUAL RAINFALL(2004-2012) OF BAGHPAT, DISTRICT

Table-2

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual/Av
2004	26.0	0.0	0.0	24.5	28.5	17.3	4.5	246.7	59.7	118.7	0.0	0.0	526.0
2005	13.8	48.2	21.8	0.0	7.3	43.2	217.5	20.0	172.0	0.0	0.0	0.0	543.8
2006	0.0	0.0	50.0	1.0	80.7	129.1	229.3	36.0	80.3	18.1	1.0	0.0	625.4
2007	1.0	1.9	75.2	0.0	22.1	133.1	20.6	3.4	14.4	0.0	0.0	0.0	271.6
2008	0.0	0.0	0.0	12.9	86.7	99.9	202.3	197.0	113.7	0.0	5.3	0.0	717.7
2009	0.0	0.0	0.0	0.0	0.0	21.0	200.5	107.3	300.0	0.0	0.0	0.0	628.8
2010	1.7	11.5	0.0	1.7	0.0	26.1	191.2	417.4	348.1	6.4	1.5	2.8	1008.2
2011	0.0	0.0	0.0	0.0	76.5	87.8	96.1	147.4	215.6	0.0	0.0	0.0	623.4
2012	14.2	0.0	0.0	15.9	0.0	16.3	69.4	135.4	53.1	0.0	1.8	16.7	322.8
Dist.Average	6.3	6.8	16.3	6.2	33.5	63.7	136.8	145.6	150.8	15.9	1.1	2.2	585.3

3.0 GEOMORPHOLOGY & SOIL TYPES

The district forms a part of Yamuna-Hindon doab in Yamuna sub-basin of Indogangetic plain. It occupies part of interfluvial belt of Ganga-Yamuna in the extreme western part of the state. The area presents an even topography with elevation of land surface from 218 to 233 m above mean sea level. The area shows a gentle slope with general average gradient 0.15m/km. The central part of the district exhibit slightly higher region which acts as water divide between rivers Yamuna and Hindon. The main eastern Yamuna canal is flowing along this, divide from north to south.

Geomorphologically, the area can be divided into three broad geomorphic units vis-a-vis older alluvial plain, older flood plain of Yamuna and Hindon rivers and the active flood plain of these rivers. Older alluvial plain is the oldest geomorphic unit which covers about 80% of the district area. The older flood plain of Yamuna & Hindon rivers are limited to the higher elevation zones and occur as narrow curvilinear, lenticular patches along the course of these rivers and are represented by either one or two terraces. The active flood plain is restricted to the present day active channels of the Yamuna, Hindon and Krishni rivers.

The development of soils in the district can be attributed to differential erosional and depositional activities. Different morphological units have been bestowed with different types of soils. The soil ranges from pure sand to stiff clays and with combinations of these are two extreme litho units. The pure sand is called Bhur, clay is called Matiyar. When the sand is mixed with clay in equal proportion, the soil may be termed as Domat or loam – a good agricultural soil. Depending upon the contents of sand and clay, there can be further classification of Domat. The word Kalhar is used to denote the bold patches where nothing grows and may be infested with Reh at patches. Alluvial soil occurring in flood plain of river is called Kamp and yield good crop – Gauhan is highly manured soils and is restricted close to villages. The area is also marked by the development of ravines and bad land at places along the banks of Yamuna, Hindon and Krishni rivers. The ravinous soils are generally rich in (Fe) iron and (Al) alluminium contents.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

District Baghpat is underlain by thick fluvial sediments deposited by the river Yamuna and Hindon with right bank tributaries. Basically deposits belong to quaternary period and are flood plain deposits. The sediments are admixture of clay and sand of different grades.

Central Ground Water Board, Northern Region under its exploratory drilling programme has drilled deep boreholes at Malakpur, Johari (Baraut block), Daha, Tikri & Burnawa (Binauli block), Ami Nagar Sarai (Pilani block), Mitli (Baghpat block) and Khekra (Khekra block) in Baghpat district down to a depth varying from 202 to 456 mbgl with an objective of mapping of subsurface sediments and aquifer system. The location of wells drilled is shown in index map as Plate-I.

On the basis of exploration carried out by CGWB, 3 tier aquifer system has been deciphered to exist in the area. These groups maintain their separate identity and have been designated as Aquifer Group – I, Aquifer Group – II & Aquifer Group – III. The cumulative thickness of granular zones in these aquifer groups varies from 40-100 m. The granular zone in Aquifer Group – I is generally thick bedded, very extensive and are consisting of comparatively coarser material than the deeper Aquifer Group – II, and III where these are thinly bedded sometimes lensoidal in nature consisting of finer sediments with the domination of silty and clayey material.

The physical characteristics, areal extent and quality of formation water in area is described as follows:

Aquifer Group – I (Depth Range 0.00 to 125 mbgl):

Ground water in this aquifer group occurs under unconfined to semi confined conditions. The cumulative thickness of granular zones varies from 55 to 105 m. Being, the main productive aquifer group, it supports to cater the major water requirement of the area through dug wells and shallow / moderately deep tubewells. Dugwells (8 to 25 m deep) fitted with handpumps and shallow tubewells (max. 45 m deep), generally tapping the phreatic zone of this aquifer group are primarily catering to the requirement of domestic, industrial and irrigational sectors. The moderately deep tubewells, 72 to 110 m deep, tapping 23 to 40 m thickness of saturated granular

zones in middle and lower parts of aquifer group, yield 1320 to 3458 lpm at drawdown ranging from 4 to 6 meters.

Central Ground Water Board has constructed an exploratory tubewell down to a depth of 130 mbgl at Aminagar Sarai (Pilana block) tapping 24 m thick saturated granular zones of Aquifer Group – I only and evaluated the different aquifer parameters with transmissivity value as 1712 m²/day and storativity value as 4.17×10^{-4} and the other hydrogeological details are given in table-3.

Aquifer Group – II (Depth Range 130 to 260 mbgl):

Ground water occurs under confined conditions. The cumulative thickness of granular zones in this aquifer group varies from 40 to 80 m. CGWB has constructed an exploratory tubewell at Daha (Binauli block) down to a depth of 251 mbgl tapping 24 m thickness of saturated granular zones of Aquifer Group – II only. The aquifer parameters obtained after conducting test are transmissivity value as 1056 m²/day and storativity value as 6.3×10^{-4} and the other hydrogeological details are given in table-3.

The depth of exploratory tubewells, constructed at village Tikri (Binauli block), Malakpur, Johri (Baraut block) ranges from 159 to 259 m and tap the granular zones of both aquifers i.e. Aquifer Group – I & II. These tubewells are yielding 1877 and 3220 lpm at drawdown varying from 3 to 14.5 m.

Aquifer Group – III (Depth Range 275 to 425 mbgl):

Ground water occurs under confined conditions. The cumulative thickness of granular zones in the group varies in the group varies from 45 to 100 m. The exploratory tubewells constructed by CGWB at village Mitli down to a depth of 376 mbgl (Baghpat block) is exclusively tapping the granular zones of this group. On conducting hydrogeological test on the tubewell the aquifer parameters obtained are transmissivity value as 345 m²/day and storativity value as 7.7×10^{-4} and the other hydrogeological details are given in table-3.

Perusal of the lithologs of the tubewell and above parameters indicate that the yield prospects of deep tubewells tapping the Aquifer Group – III which encompasses the entire Baghpat district are not very promising due to domination of fine sediments and by and large their lenticular disposition. However, in Ganga sub basin the sediments are moderately thick bedded and have better prospects.

The summarized hydrogeological data of the tubewells constructed by state agencies in district is presented as table-4.

SUMMARISED HYDROGEOLOGICAL DATA OF EXPLORATORY TUBEWELLS/PIEZOMETERS CONSTRUCTED BY CGWB IN BAGHPAT DISTRICT Table-3

S.No.	Location, Co-ordinates, toposheet (R.L. in mamsl)	Type of tubewell	Depth drilled (m)	Granular zones tapped (mbgl)	SWL (mbgl)	Discharge (lpm)	Specific capacity (lpm/m)	T (m ² /day)	S	Remarks Bedrock (BR) E = Encountered NE = Not Encountered
		Year of construction	Depth of tubewell (m)		Month/Year	Drawdown (m)			K (m/day)	
	1	2	3	4	5	6	7	8	9	10
1	ET-1 Tikri 29°13'15": 77°20'48"	EW	455.56 159.00	63.00-69.00 75.00-87.00 99.00-111.00 135.00-141.00 147.00-153.00	18.85 2/04	1877 3.00	626	-	-	BR=NE
2	ET-2 Daha 29°11'45":77°25'10" 53G/8	EW 1994	456.00 251.00	187.00-196.00 215.00-218.00 233.00-245.00	17.88 8/1997	2210 6.30	351	1055.73	6.3×10 ⁻⁴ 43.98	BR=NE (EC 490 μ mhos/cm at 25° C)
3	ET-3 Malakpur 29°07'15":77°03'35"	EW 1977	202.04 190.00	43.00-54.00 74.00-82.00 121.00-126.00 158.5-166.00 179.00-185.00	3.10	3220 6.15	524	1500	2.05×10 ⁻³ 19.50	BR=NE (EC 635 μ mhos/cm at 25° C)
4	ET-4 Johari 29°06'30":77°72'20" 51G/8	EW 1977	451.00 256.00	39.00-57.00 67.00-80.00 157.00-165.00 171.00-177.00 237.00-250.00	12.26	1987 14.44	138	705	7.75×10 ⁻⁴	BR=NE (EC 808 μ mhos/cm at 25° C)
5	ET-5 Mitali 28°57'35":77°18'15"	EW 1976	451.34 376.00	289.00-300.00 304.00-310.00 325.00-335.00 345.00-358.00 362.00-370.00	3.98	1360 25.5	53.21	345	7.7 ×10 ⁻⁴	BR=NE (EC 700 μ mhos/cm at 25° C)
6	ET-6	EW	250.15	64.00-76.00	14.25	1557	322	1711.86	4.17×10 ⁻⁴	BR=NE

S.No.	Location, Co-ordinates, toposheet (R.L. in mamsl)	Type of tubewell	Depth drilled (m)	Granular zones tapped (mbgl)	SWL (mbgl)	Discharge (lpm)	Specific capacity (lpm/m)	T (m ² /day)	S	Remarks Bedrock (BR)
		Year of construction	Depth of tubewell (m)		Month/Year	Drawdown (m)			K (m/day)	
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>
	Aminagar Sarai 28°58'48":77°23'00" 53H/5	1999	130.00	112.00-118.00 121.00-127.00	7/2000	4.84			95.07	
7	ET-7 Khekra	EW 1999	442.20 69.00	42.00-48.00 54.00-66.00	-	-	-	-	-	BR=NE
8	Pz Barnawa 29°06'42:77°25'30" 53G/8	Pz 1995	452.01 416.0	360.00-372.00 383.00-395.00 398.00-410.00	14	-	-	-	-	Temp-42°C (Hot water spring well) BR=NE
9	Pz Pilana 28°43': 77°39' 53H	Pz 2003-04	60.80	52.15-58.20	-	-	-	-	-	-
10	Pz Bagpat	Pz	51.0	43.50-49.50	-	-	-	-	-	-

HYDROGEOLOGICAL DATA OF THE TUBEWELLS CONSTRUCTED BY STATE/OTHER AGENCIES IN BAGHPAT DISTRICT, U.P.

Table-4

Well No., Location, Toposheet No., Owner	Year of construction	Depth drilled	Granular zones encountered	Granular zones tapped	Static water level	Discharge	Drawdown	Specific capacity	Remarks
		Depth of tubewell (mbgl)	(mbgl)	(mbgl)	(mbgl)	(lpm)	(m)	(lpm/m)	
ST-1, Jafarpur, 53G/4 State Govt.	1973	84.40	30.50-64.00	32.60-62.50	5.50	3150	4.60	685	
		82.60	73.15-80.50	73.70-79.70					
ST-2, Ganjnoli 53G/8 State Govt.	1965	83.80	9.18-18.30	31.10-35.00	10.70	3337	4.90	681	
		82.30	27.43-64.00 73.10-79.80	39.30-63.40 72.80-78.60					
ST-3 Gendbra (Gedhara) 53G/8 State Govt.	1940	97.50	37.50-67.902	51.80-64.00	13.40	2174	4.10	530	Abandoned
		91.40	75.30-91.40 94.20-96.90	74.70-91.40					
ST-4 Kanhar, 53G/8 State Govt.	1946	83.20	6.10-9.15	31.10-83.20	-	2601	-	-	-
		75.00	27.50-35.00 44.20-74.10						
ST-5 Bemnauli, 53G/8 State Govt.	1955	91.50	24.40-30.50	39.60-46.30	12.80	3399	4.60	738	-
		83.80	41.15-45.70 48.16-80.16 81.69-86.26	52.42-55.50 61.60-64.30 70.10-79.80					
ST-6, Barnawa, 53G/8 State Govt.	1963	109.70	13.70-18.30	52.30-57.7	12.20	1543	4.90	315	Abandoned
		108.50	27.40-36.60 42.70-57.90 64.00-83.20 86.90-109.70	64.00-83.20 88.90-91.20 100.60-107.30					
ST-7, Galetha,53G/8 State Govt.	1962	102.80	46.30-56.40	45.70-55.80	11.90	2287	4.90	467	Abandoned
		102.80	67.70-84.10 92.60-101.80	70.10-84.10 92.60-97.20 99.40-102.10					
ST-8, Bijwara, 53G/8 State Govt.	1966	85.30	27.40-80.80	39.80-60.80	7.0	2683	4.90	547	-
		84.10		67.40-79.50					

Well No., Location, Toposheet No., Owner	Year of construction	Depth drilled	Granular zones encountered (mbgl)	Granular zones tapped (mbgl)	Static water level (mbgl)	Discharge (lpm)	Drawdown (m)	Specific capacity (lpm/m)	Remarks
		Depth of tubewell (mbgl)							
ST-9, Budhera, 53G/8 State Govt.	1972	88.30	12.20-33.53	29.10-32.60	4.6	4299	4.0	1075	-
		78.00	42.67-76.20	43.90-74.70					
ST-10, Harya Khera, 53H/5 State Govt.	1962	100.00	7.62-16.80	46.60-57.00	12.80	3029	4.60	658	-
		99.00	45.10-57.90 68.30-80.20 85.30-98.70	68.30-76.20 86.20-98.10					
ST-11, Dolcha-I, 53H/5 State Govt.	1989	86.90	18.30-24.10	30.50-71.60	-	-	-	-	-
		74.70	32.30-66.10 68.30-71.90 75.30-77.70						
ST-12, A.F. Station Baghpat, 53H/5 Air Force	-	91.40	24.30-31.70	26.50-31.60	7.55	1320	-	-	-
		75.30	42.70-59.40 63.70-74.40	36.70-49.00 62.60-74.60					
ST-13, Bandpur, 53H/5 State Govt.	1966	79.20	8.50-15.80	40.50-42.70	6.70	2363	4.60	514	-
		76.20	27.40-31.70 33.50-45.10 59.70-74.70	49.70-56.70 61.00-74.70					
ST-14, Gauma, 53H/5 State Govt.	1689	108.20	7.60-10.70	33.80-60.60	-	-	-	-	-
		103.10	16.70-21.30 32.90-61.00 79.20-80.50 94.50-99.10						
ST-15, Singholi, 53H/5 State Govt.	1974	73.10	9.15-12.20 18.30-27.45 33.55-70.10	33.80-52.70 54.20-69.70	7.60	3458	4.30	804	-

4.2 DEPTH TO WATER LEVEL:

CGWB has only one functional piezometer at Pilana in the district, therefore data of permanent monitoring wells of State GWD has been utilized. Depth to water level in the area during premonsoon period of 2012 vary from 4.71 mbgl (Shahpur Bidauli, bock Baraut) to 32.03 mbgl (Pusar, bock Binali) and in postmonsoon period it varies from 4.72 mbgl (Shahpur Bidauli, bock Baraut) to 32.08 mbgl (Pusar, bock Binali). The water level is comparatively shallower in the vicinity of Yamuna and Hindon rivers and upper part of Yamuna canal whereas in the remaining part of the district, deeper water levels are observed. The water levels are relatively deeper in Binauli and Pilana blocks in comparison with Chhaprauli, Baraut, Khekra and Bagpat blocks. The pre- and post monsoon depth to water level maps have been prepared and are presented as Plate-II & -III and hydrogeological map of the district has been presented as Plate-IV .

The depth to water level in Baghpat block during pre monsoon period ranges from 8.55 (Sujra) to 24.99 mbgl (Dhanaura Silverpur) and during post monsoon it ranges from 6.10 (Sujra) to 22.81 mbgl (Dhanaura Silverpur). The depth to water level in Baraut block during pre monsoon period ranges from 4.71 (Shahpur Bidauli) to 24.79 mbgl (Dhanaura Silverpur) and during post monsoon it ranges from 4.72 (Shahpur Bidauli) to 24.08 mbgl (Dhanaura Silverpur). The depth to water level in Chhaprauli block during pre monsoon period ranges from 9.50 (Kurdi) to 22.77 mbgl (Chadanhedi) and during post monsoon it ranges from 9.45 (Kurdi) to 22.75 mbgl (Chadanhedi). The depth to water level in Pilana block during pre monsoon period ranges from 8.62 (Baleni) to 25.95 mbgl (Budhseni) and during post monsoon it ranges from 8.62 (Baleni) to 26.0 mbgl (Budhseni). The depth to water level in Khekra block during pre monsoon period ranges from 11.50 (Phulera) to 23.33 mbgl (Khekra) and during post monsoon it ranges from 10.70 (Phulera) to 24.41 mbgl (Khekra). The depth to water level in Binauli block during pre monsoon period ranges from 14.80 (Barnawa) to 32.03 mbgl (Pusar) and during post monsoon it ranges from 14.90 (Barnawa) to 32.08 mbgl (Pusar).

4.3 LONG TERM WATER LEVEL TREND:

For the period 2003-12 the long term water level trend for only Pilana Piezometer of CGWB is available that shows declining pre monsoon trend of 1.5 m/yr and declining post monsoon trend of 0.28 m/yr and annual declining trend of 1.02 m/yr. Due to insufficient data available with CGWB, the average block wise long term water level trend values for the period 2001-2010 are described below. The Baghpat block shows declining pre monsoon trend of 1.34 m/yr and declining post monsoon trend of 1.07 m/yr. The Baraut block shows declining pre monsoon trend of 0.94 m/yr and

declining post monsoon trend of 1.17 m/yr. The Binauli block shows declining pre monsoon trend of 0.43 m/yr and declining post monsoon trend of 0.65 m/yr. The Chhaprauli block shows declining pre monsoon trend of 0.84 m/yr and declining post monsoon trend of 0.62 m/yr. The Khekra block shows declining pre monsoon trend of 1.39 m/yr and declining post monsoon trend of 1.25 m/yr. The Pilana block shows declining pre monsoon trend of 1.44 m/yr and declining post monsoon trend of 1.55 m/yr.

4.4 GROUND WATER RESOURCES:

To facilitate the judicious ground water development, the dynamic ground water resources have been worked out. The blockwise resources are presented in table -5. A review of blockwise ground water resource potential data reveals that all blocks except Baraut fall in over exploited category. The average stage Stage of Ground Water Development in the district has been estimated at 116.61%.

The net annual ground water availability in the district as on 31.3.2009 has been calculated as 37838.95 ha.m whereas net ground water availability for future irrigation development comes out to be negative in value for whole of the district, thus having no balance for future development. Hence no future additional ground water structure may be recommended for utilizing dynamic ground water resources except for Baraut block where net ground water availability for future irrigation development works out to be 1058.32 ha.m. The Baraut block falls in Semi Critical category where stage of ground water development is 85.57%.

The share of surface irrigation in the district is only about 3.07% of the total net irrigation. In the eastern Yamuna canal command area, the irrigation by surface water is being carried out over an area of 3256 ha. through 435 Km length of canals. The surface water irrigation efficiency should be improved to de stress the ground water aquifers in the area. Categorisation of blocks, ground water resources, draft etc. is presented in the form of a map as Plate- V.

Table-5

DYNAMIC GROUND WATER RESOURCES OF BAGHPAT DISTRICT (AS ON 31 MARCH, 2009)**(in ham)**

Sl. No.	Assessment Units - Blocks	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
		10	11	12	13	14	15	16	17
1	BAGHPAT	5980.02	5575.50	427.31	6002.81	427.31	0.00	100.38	Over Exploited
2	BARAUT	8612.21	7043.88	310.01	7353.89	510.01	1058.32	85.57	Semi Critical
3	BINAULI	5522.27	9279.30	461.97	9741.27	461.97	0.00	154.08	Over Exploited
4	CHAPRAULI	6635.61	7204.20	342.96	7547.16	342.96	0.00	113.74	Over Exploited
5	KHEKRA	5908.45	6295.75	372.21	6667.96	372.21	0.00	112.85	Over Exploited
6	PILANA	5180.39	6481.00	330.98	6811.98	330.98	0.00	131.50	Over Exploited
	TOTAL	37838.95	41879.63	2245.44	44125.07	2445.44	1058.32	116.61	

4.5 GROUND WATER QUALITY:

Ground water in shallow aquifers, in general is potable and suitable for irrigation and industrial purposes. The electrical conductivity of ground water in phreatic zone ranges from 690 (Binauli block H/P) to 1430 $\mu\text{s}/\text{cm}$ at 25 °C (Pilana block H/P). The value of Fluoride content ranges from 0.04 (Pilana block H/P) to 1.85 mg/l (Baraut block H/P) and Nitrate value ranges from 0.1 mg/l (Khekra block H/P) to 90 mg/l (Bagpat block H/P). The Nitrate content >45mg/l is also observed at Pilana block H/P at 65 mg/l. The high Nitrate content is most likely due to the use of fertilizers for agriculture and improper waste disposal. All other constituents viz. Th, Ca, Mg, Na, HCO₃, SO₄, K, Cl are within permissible limits. Ground water quality of deeper aquifer is also potable and suitable for irrigation and industrial purposes.

4.6 STATUS OF GROUND WATER DEVELOPMENT (BLOCKWISE):

In Baghpat district, the salient features of ground water structures are as below:

Table-6

SALIENT FEATURES OF GROUND WATER STRUCTURES IN BAGHPAT DISTRICT

Sl. No.	Name of ground water structures	Depth range (mbgl)	Diameter (m)	Discharge range (lpm)	Types of pumps as water lifting device	Use
1.	Dugwells	7-20	1.40-2.50	-	Rope & Bucket	Mostly abandoned
2.	Private Tubewells/Boring	30-40	0.1-0.2	500-600	Electric/Diesel operated	Water supply for domestic & irrigation
3.	Public (State) Tubewells	75-110	0.30-0.35	1300-4200	Electric operated	Water supply for domestic & irrigation

The blockwise sources of irrigation and irrigated area by different sources are given in table.

Table-7

BLOCKWISE SOURCE OF IRRIGATION AND IRRIGATED AREAS

As on 31.03.2012

Sl. No.	Name of block	Irrigated area by canals (surface irrigation) (ham)	Canals length (km)	Irrigated area by public tubewells (ham)	No. of public tubewells (state T/W)	Irrigated area by private T/W Borings (ham)	No. of private T/W & borings
1.	Chhaprauli	364	76	59	6	14207	4458
2.	Baraut	484	156	179	19	19185	5769
3.	Baghpat	379	86	94	14	15672	4674
4.	Pilana	382	56	208	51	16960	3807
5.	Khekra	371	47	199	32	12678	3304
6.	Binauli	384	14	130	80	18600	4346
	Total Rural	2364	435	869	202	97302	26358
	Total Urban	892	0	132	17	4009	0
	Total	3256	435	1001	219	101311	26358

The long term water level data shows that except at few places, the entire district exhibits a declining trend of water level resulting in drying out the number of dugwells and also shallow ground water structures.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

The stage of ground water development in the district is 116.61 %. This is quite high and calls for adoption of a careful strategy for further ground water development due to declining ground water trend. In canal command area, strategy of conjunctive use of surface and ground water needs to be adopted for future ground water development.

Keeping in view the negative availability of ground water resources in the district, over exploited category of ground water development for all the blocks except only one block i.e. Baraut, that too falls in semi critical category and very high overall stage of development for whole of the district, there is no feasibility for further ground water abstraction structures in the district. The emphasis should be on increasing recharge and decreasing discharge by way of efficient agriculture practices and surface water irrigation. Ground water development should be carried out only through replacement wells tapping the second and third group of aquifers leaving the first aquifer, where the pre-existing wells have become dysfunctional rather than constructing additional wells in the area.

5.2 WATER CONSERVATION STRUCTURE & ARTIFICIAL RECHARGE:

In Baghpat district water levels are declining at a fast rate and all the blocks except one (Baraut- semi critical) fall in over exploited category of ground water development. In the urban areas rooftop rain water harvesting should be encouraged and it should be made mandatory in upcoming townships of the district. In rural areas attempts should be made to rejuvenate dried up ponds and lakes. Natural depressions may also be targeted after slope modification to serve as percolation tanks. Other artificial recharge options such as gabion structures, gully plugs, check dams, stop dams, recharge shafts etc. wherever feasible should also be explored in the district to utilize the surplus monsoon runoff in deeper depth to water level areas. The areas around Binauli, Pilana, Daha and Khekra are the priority areas where such measures should be adopted urgently due to very deep water levels. In the other areas also arteficial recharge has to be implemented due to deep water levels.

Ground water in parts of Khekra block at deeper levels is brackish to saline. Formulation and implementation of large scale artificial recharge to ground water is a key solution to the problem. To arrest decline of water level, Central Ground Water Board, SUO, Bareilly implemented two artificial recharge schemes at Garhi Kampran and Changama villages, block Binauli by constructing trenches with recharge wells to harness the available runoff in the area.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

The major ground water related issue and problem is of deep and declining ground water levels. In some parts deterioration of quality due to occurrence of high values of nitrate and fluoride greater than permissible limit is also observed. There is no water logged, drought affected area reported from the district. No drilling problems or natural disaster etc are faced in any part of the district.

7.0 AWARENESS & TRAINING ACTIVITY

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

A mass awareness programme (MAP) was organised by Central Ground Water Board in Daha, Tikri and Nirpura villages of Chaugana area in block Binauli on 30/05/99. Shri Som Pal Shastri, Minister of Water Resources, Govt. of India was chief guest. Senior officers of CGWB, MLA's, Gram Pradhan, Officers / officials of state government, teachers of schools and villagers participated in the programme. More than 300 people took part in the programme. No management training programme yet has been organised by CGWB in the district.

7.2 PARTICIPATION IN EXHIBITION, MELA, FAIR ETC.:

No exclusive exhibition, Mela, Fair etc. has been organised in the district so far. However, an exhibition of model of drilling rig machine and chemical equipment was organised during the mass awareness programme at Daha Girls Intermediate College on 30/05/99.

7.3 PRESENTATION & LECTURES DELIVERED IN PUBLIC FORUM / RADIO / TV / INSTITUTION OF REPUTE / GROSS ROOTS ASSOCIATION / NGO / ACADEMIC INSTITUTION ETC.:

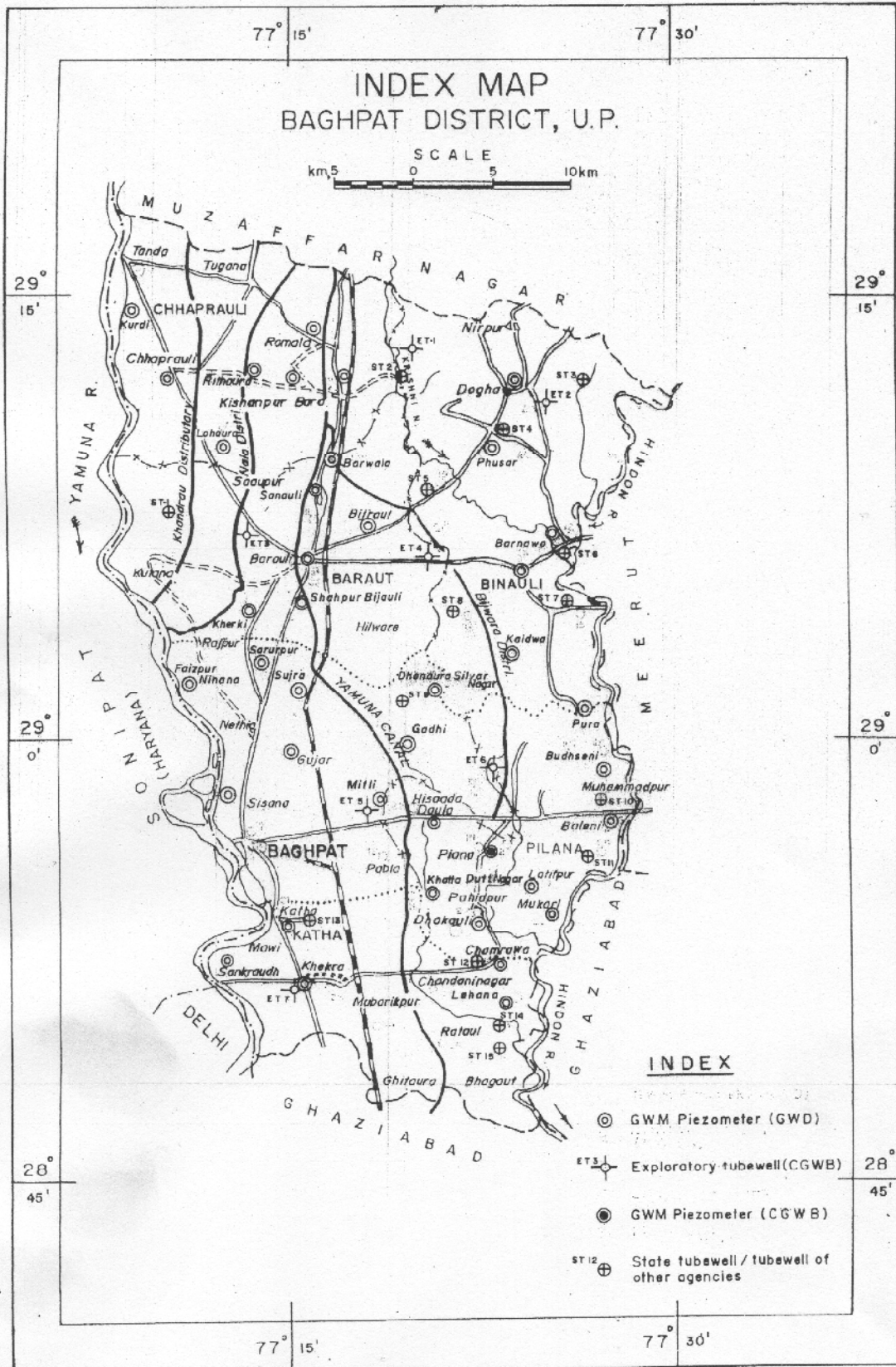
No presentation & lecture delivered in public for CGWB in the area.

8.0 AREA NOTIFIED BY CGWA/SGWA

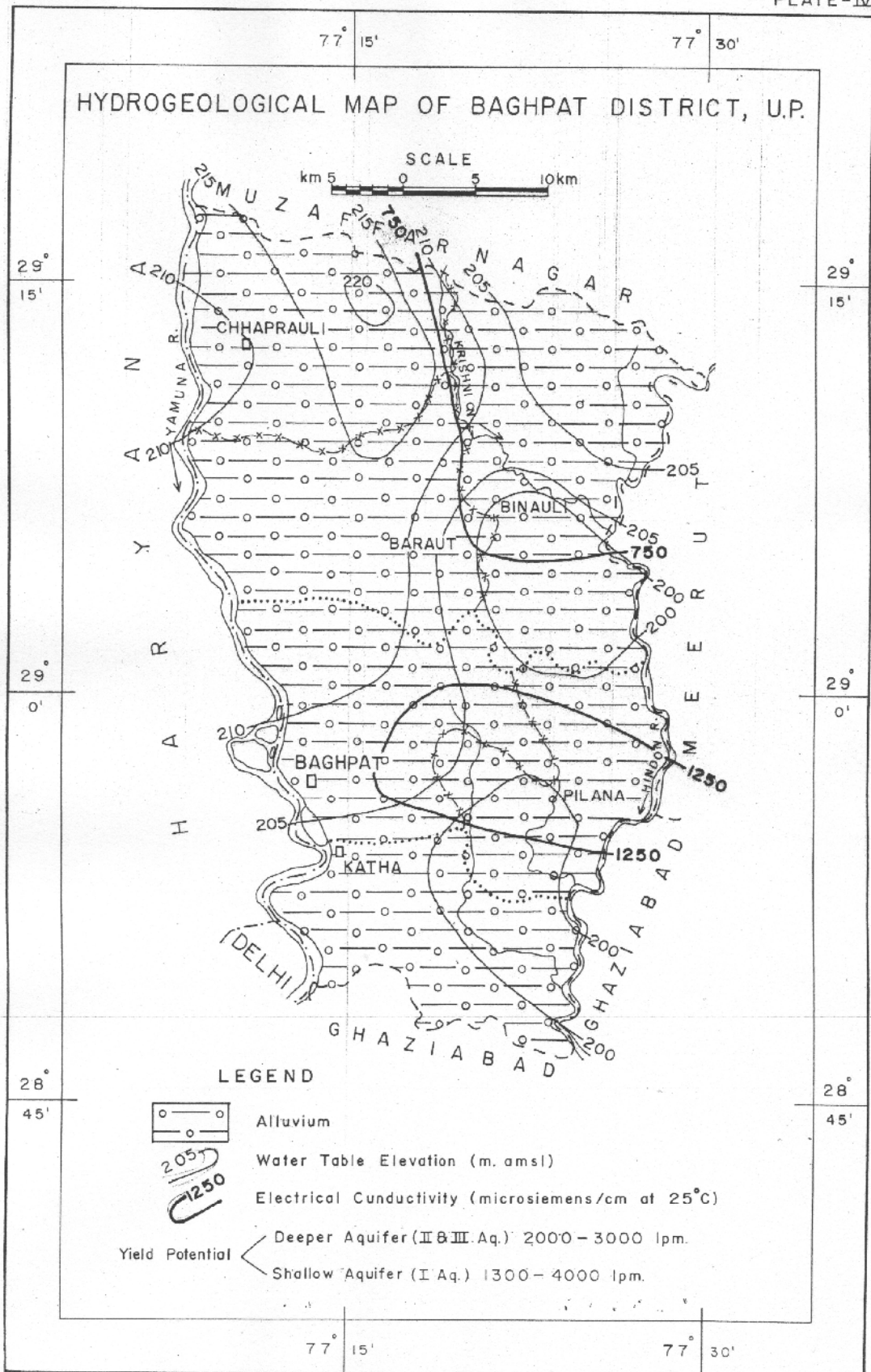
In the district no area or block has been notified by Central Ground Water Authority / SGWA till date.

9.0 RECOMMENDATIONS

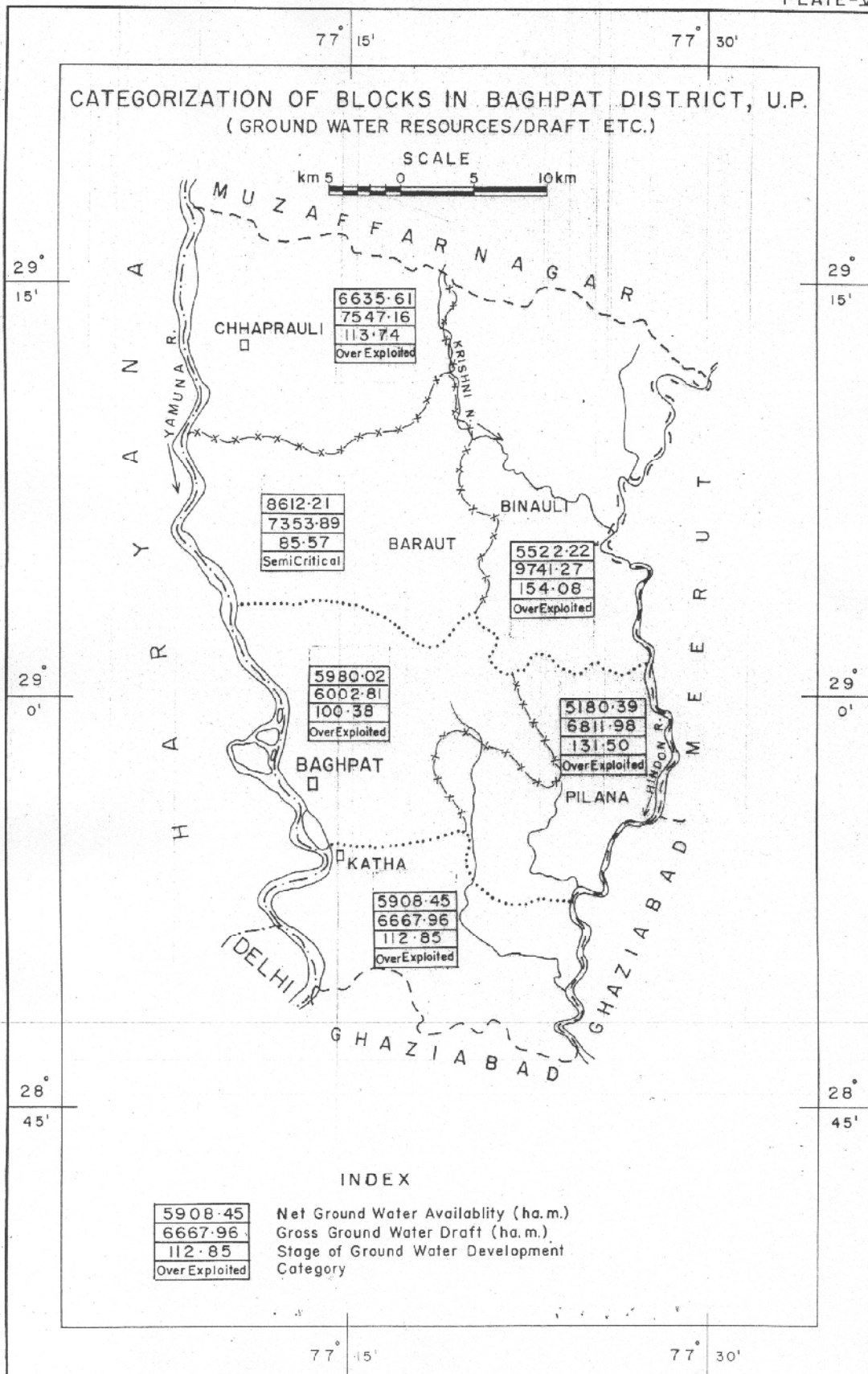
- (a) Based upon available data in the district, it is observed that water level is declining very fast therefore, it is strongly recommended that exploitation of ground water through tubewells in the first aquifer group be stopped.
- (b) Since about 90% ground water requirement is being catered by Aquifer Group – I and partly by Group – II, a declining trend in ground water levels has regionally been observed. To check this trend and minimise the stress on shallow aquifers, new tubewells should tap the ground water from Aquifer Group – II & III only.
- (c) Possibilities of artificial recharge to surmount over stressed ground water system in the district should be studied and implemented.
- (d) Introduction of drip and sprinkler irrigation shall help in arresting the declining water level trends. Such practices should be initiated in rural areas and the trend of ground water levels monitored from time to time to control and regulate the situation.
- (e) Canal water may be regulated so as to implement the conjunctive use of surface and ground water effectively.
- (f) Attention should be paid to improve the drainage system, sanitation and solid waste management in the district especially in urban areas.
- (g) The grass root user should be made aware about the alarming situation developing in the district. All the stake holders including State government departments, NGO's etc. should be provided training for capacity building to prepare and equip them to tackle the situation in a prudent manner.



CGWB, NR, (RAKESH), Drg. No. 1696/04, 4341/II. (N. Chandra) Drg. No. 4934/13



CGWB, NR, (RAKESH), Drg. No. 2702/09, (N.Chandra) Drg. No. 4936/13



C.G.W.B., NR, (RAKESH), Drg. No. 2702/09, (N.Chandra) Drg. No. 4937/13