

GROUND WATER BROCHURE OF KAUSHAMBI DISTRICT, U.P.

(A.A.P:2012-13)

By

T.K. Pant

Scientist-B'

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DISTRICT AT GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 1780
ii. Administrative Division (as on 31.3.2012)	
a) Number of Tehsil	: 3
b) Number of Block	: 8
c) Number of Nyaya Panchayat	: 88
d) Number of Village	: 868
iii. Population (as on 2011 census)	: 1596909
iv. Average Annual Rainfall (mm)	: 864

2. GEOMORPHOLOGY

Major Physiographic Units	: Two physiographic units namely i) Trans Ganga and ii) Doab Yamuna. Trans Ganga area is on the north of River Ganga and the Doab area lies between Ganga and Yamuna.
Major drainage	: Khiladi nadi and Sasur Khaderi nadi part of Yamuna river sub basin which again is part of Ganga drainage system.

3. LAND USE (Ha.)

a) Forest area	: 185504
b) Net area sown	: 133391
c) Net irrigated area	: 91282

4. MAJOR SOIL TYPES

: Older alluvial soil consisting broadly of Bhur or sandy, Matiyar or clay rich and Domat or loam.

5. AREA UNDER PRINCIPAL CROPS (As on 2010)

Ha.

: Rabi :94235
Kharif : 73927
Zaid : 3379

6. IRRIGATION BY DIFFERENT SOURCES

(Areas in ha. and Number of Structures)

Dug wells	: 0
Tube wells / Bore wells 274 Nos.	: 3241
Tanks / Ponds	: 35
Canals (Length = 494 Km)	: 17594

- Other sources : 0
- Net Irrigated Area : 91282
- Gross Irrigated Area : 118905
- 7. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 2009)**
- No. of Dug wells : 17
- No. of Piezometers : Nil
- 8. PREDOMINANT GEOLOGICAL FORMATIONS** : Quaternary Alluvial comprising of older and newer Alluvium over Vindhyan Plateau with lateritic capping at places.
- 9. HYDROGEOLOGY AND AQUIFER GROUP** : District lies in the doab of Ganga and Yamuna. Ground water occurs in thick zone of saturation of unconsolidated sediments. Two-tier aquifer system prevails;

I Tier	Ground level to 120 meter, Phreatic
II Tier	150m to basement, Confined.

Major water bearing formation: Quaternary sediments deposited over concealed basement making to major fresh water aquifer groups.

- (Pre-monsoon Depth to water level during May' 2012) : 9.00 to 23.80 mbgl
- (Post-monsoon Depth to water level during Nov' 2012) : 5.04 to 19.05 mbgl
- Long term of water level trend in 10 years (2003-2012) in m/year : Rise= nil
Fall = 0.0545 to 1.1609

10. GROUND WATER EXPLORATION BY CGWB (As on 2012)

- No. of wells drilled (EW, PZ, SH, Total) : EW-07, SH-01, PZ-01=09
- Depth Range (m) : 101.66-282.60 mbgl
- Discharge (liters per minute) : 1000-4000
- Storativity (S) : N.A.
- Transmissivity (m^2/day) : 2935 to 3660

11. GROUND WATER QUALITY

- Presence of Chemical constituents more than permissible limit (e.g. EC, F, NO_3 , As, Fe) : $NO_3 > 45mg/l$ at Sirathu block. No relaxation, and $F > 1.5$, (2.6) recorded at Sarsawan block.

	Type of water	Good water quality zone
12.	DYNAMIC GROUND WATER RESOURCES (2009)-in HAM	
	Annual Replenish able Ground Water Resources	: 40932.78
	Gross Annual Ground Water Draft	: 32616.29
	Projected Demand for Domestic Industrial Uses up to 2033	: 5753.15
	Stage of Ground Water Development	: 79.68%
13.	AWARENESS AND TRAINING ACTIVITY	:
	Mass Awareness Programmes organized	: Nil
	Date	
	Place	
	No. of Participants	
	Water Management Training Programme (Artificial Recharge) organized	
	Date	: NI
	Place	:
	No. of Participants	:
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	
	Projects completed by CGWB (No of Amount Spent)	: NA
	Projects under technical guidance of CGWB (Numbers)	: NA
15.	GROUND WATER CONTROL AND REGULATION	:
	Number of OE blocks	: 02
	Number of critical blocks	: 03
	Number of blocks notified	: Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	: Broadly Natural and Geo- environmental problems occur. ie Natural Hazards like Flood common in low lying Yamuna terrace, Soil Alkalinity is wide spread in northwestern and southwestern parts mostly lying in the region between Ganga and Sasror-Khadri river. Badland topography caused by head ward erosion due to higher river ward slope on erodible litho logy found mostly developed along Yamuna and Sasar-Khadar river.

GROUND WATER BROCHURE OF KAUSHAMBI DISTRICT, U.P.

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1.0 INTRODUCTION

Kaushambi district was carved out of Allahabad and lies between 25⁰15'30'' and 25⁰47'45'' north latitude and 80⁰09'00'' and 81⁰49'00'' east longitude in survey of India toposheet 63G. Total geographical area of the district is 1780 sq. km. District headquarter is at Kaushambi having 3 (three) number of tehsils and 8 (Eight) number of blocks. As per the 2011 census the district has population of 1596909 of which 838095 males and 758814 females. Scheduled caste population is 196040 and scheduled tribe population is 60. Literacy rate of the district is 63.05%. Geographically the area comprises Quaternary alluvium sediments heterogeneous in nature are deposited over the concealed basement of Vindhyan sandstone and shale of varying thickness. The main and major drainage of the district belong to the Ganga river system of which river Yamuna and Sasur Khadaiare tributaries.

Physiographically the area can be divided into two units –

- (1) Trans Ganga lies to the north of Ganga River.
- (2) Doab Yamuna which lies between Ganga on the north and Yamuna on the south.

Agriculture is the main source of economy of the district. Both surface and ground water are used for irrigation. The net irrigated area is 91282 Ha and the net area sown is 133391 Ha, which shows that 68.43% area is irrigated and the rest area depends on rainfall. Length of canal in the district is 494 Km. and the number of government tube wells is 274.

Kaushambi district is drained by Ganga river system of which Yamuna, Kilhahi nadi and Sasur Khadai are tributaries. The Ganga enters the district through Kara block where as Yamuna first touches the district in the extreme west at Sarsawan block and flows over a length of 80km before joining Ganga.

The district was covered under hydrogeology and ground water potential study by Shri N.C.Bhatnagar and Shri S.P.Khanna in 1964-65 and 65-66 respectively. Reappraisal survey was carried by Shri S.K.Bansal in 1978-79 later on by G.D.Bhartwal in 1992-93 followed by Shri A. Kumar in 1994-95.

2.0 RAINFALL & CLIMATE

The average annual rainfall is 864 mm. The climate is typical sub humid punctuated by long and intense summer and mild winters. About 88% of the annual rainfall is received from south-west monsoon. May is the hottest month with temperature shooting up to 44.8⁰C. With the advance of monsoon by about mid June, temperature starts decreasing. January is usually the coldest month with the temperature going up to 12⁰C.

The relative humidity is highest during south-west monsoon ranging between 80% to 85% with its lowest around 30% during peak summer months of April and May.

3.0 GEOMORPHOLOGY & SOIL

3.1 Geomorphology:

The district is characterized by mainly five geomorphic units i)Flood plain ii)Younger Alluvial plain iii)Older Alluvial plain iv)Alluvial plain with salt encrustation and v) Ravenous land. The master slope of the area is mainly towards east.

Flood plain: The Yamuna river channel and its adjacent area forming terraces which are subjected to periodic flooding, consisting of sand, silt and silty sand with minor clays, form the flood plain of river. This is a narrow zone along the river channel and gets flooded regularly during rainy season.

Yonger Alluvial Plain: The area occupied by younger alluvium can be delineated all along Ganga river and other tributary streams draining the district. The younger alluvium is confined.

Older Alluvial Plain: The older alluvium occupies the entire upland or interfluves area occurring between the major drainages i.e. Sasur Khaderi and Kilnahi nadi comprising of sands of different grades, silt and clay.

Alluvial Plain with salt Encrustations: Alluvial Plain with salt encrustations has been observed in patches in Bara and Jasra blocks of erstwhile district of Allahabad.

Ravenous Land: Small narrow depressions; smaller than gully usually carved by running water have also been observed along rivers and small nadis.

3.2 Soil:

Kaushambi district comes under the doab region of Ganga and Yamuna rivers covered by older Alluvial. The development of soils in the district can be ascribed to different erosion and depositional agencies. Different morphological units have different types of soil. The soil ranges from pure sand to stiff clays and including all combination of the two extreme litho units. The pure sand is called **Bhur** and clay is called **Matiar** when the sand is mixed with clay in equal proportion, the soil may be termed as **Dumat or Loam** – a good agricultural soil.

3.3 Geological set up:

The Geological setup of the district comprises of rocks of Vindhyan super group and Quaternary sediments classified into older and newer Alluvial. The Vindhyan super group is represented by Kaimur group of rocks consisting of shale and sandstone; the rocks are generally undisturbed deposited with very shallow dips of 2° to 5° , towards south.

The Geological succession is as follows.

GEOLOGICAL SUCCESSION

Group/Formation	Litho logy	Age
Quaternary Newer Alluvial	Sequences of clay and fine sand with silt	Holocene
Older Alluvium	Alternate sequence of silt, clay and sand with Kankar	Early to late Pleistocene

Vindhyan Super Group	Rewa Group Shale and Sand stone Kaimur Group Quartzite	Meso to Neo Proterozoic.
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4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

Depth To Water Level I: Depth to water level(DWL) data collected from Ground Water Monitoring Wells in May' 2012 and Nov' 2012 have been utilized to prepare depth to water level contour maps.

Table:1 Water Level and Fluctuation (Pre & Post-monsoon) for the year 2012

Sl. No.	Ground Water monitoring well	Block	Pre-monsoon DWL (May' 12) (mbgl)	Post-monsoon DWL (Nov' 12) (mbgl)	Fluctuation (m)
1.	Ajrauli	Sarsawan	-	5.32	-
2.	Kailashpuri	Kaushambi	23.80	-	-
3.	Kaushambi	Kaushambi	11.95	-	-
4.	Lehdari	Kara	15.32	13.35	1.97
5.	Mahgaon	Muratganj	-	16.85	-
6.	Mandari	Chail	23.18	19.05	4.13
7.	Perai	Newada	17.60	-	-
8.	Sallaahpur	Chail	16.75	14.95	1.80
9.	Sarai akil	Newada	15.55	13.23	2.32
10.	Usargaura	Manjhanpur	9.00	5.04	3.96

A perusal of the table and depth to water level contour map for the period May'2012, reveal that water level varies from 9.00 mbgl as seen in Usargaura in Manjhanpur Block to 23.80 mbgl in Kailashpuri in Kaushambi block. Almost all the blocks, covering approximately 70% area of the district show DWL between 10 to 15 mbgl. Parts of Kailashpuri and Mandari (30% of area) show DWL between 15 to 20 mbgl. The data reveal that no well is showing DWL < 9 mbgl.

A perusal of the table and depth to water level contour map for the period November' 2012 reveal water level has become shallower and varies from 5.05 mbgl in Manjhanpur block to 19.05 m in Chail block. The data reveal that no well is showing DWL < 5 mbgl. About 50% of the area lies in 10-15 m.b.g.l area.

Seasonal Fluctuation:

Water Level/table fluctuates in response to recharge to the aquifer and withdrawal from the aquifer. The quantum of fluctuation is a direct function of the above. Recharge takes place mainly during rainy season. The minimum depth to water level in an area is expected sometime at the close of monsoon or in the middle of monsoon period depending upon the intensity and duration of rainfall as well as soil characteristics and maximum depth to water level is expected to be just before the rainfall. The part of the rainfall in the initial period goes towards meeting the soil moisture deficiency as well as to saturate the Evapotranspiration losses.

Annual Seasonal Fluctuation of Water Level

Annual Seasonal Fluctuation of Water Level has been determined from the Pre-monsoon (May'2012) and Post-monsoon (Nov'2012) water level data of Ground Water monitoring wells. The fluctuation varies from min 1.80 mbgl to max 4.13 mbgl in Sallahpur and Mandari both in Chail block.

Long term trend of water level

Table2: shows the long term trend of water level of Ground Water monitoring wells for ten year period 2003 to 2012.

S/n	Location	Premonsoon rise (m/yr)	Premonsoon Fall (m/yr)	Post monsoon rise(m/yr)	Post monsoon Fall(m/yr)	Annual Rise (m/yr)	Annual Fall (m/yr)
1	Sallahapur	-	0.4510	0	0.1916	-	0.2899
2	Khokraaj	-	0.3479	-	0.4170	-	0.5149
3	Mandari	-	0.3703	-	0.1827	-	0.1539
4	Andawa	-	0.3587	-	0.5188	-	-
5	Mahgaon	-	0.4594	-	0.1064	-	0.2420
6	Lehdari	-	0.1491	-	0.0099	-	0.0545
7	Sirathu	-	-	-	0.2711	-	0.2769
8	Sarai akil	-	0.6821	-	0.5860	-	0.4899
9	Kotari	-	-	-	1.4478	-	1.1609
10	Usargaura	-	0.4364	-	0.2619	-	0.2775
11	Kaushamba		0.2185	-	0.4018	-	0.2914
12	Kailashpuri		0.3391	-	0.3490	-	0.2195
13	Ajrauli		0.6209	-	0.3911	-	0.2676
14	Perai		0.3893	-	0.4510	-	0.2140

Long Term Water Level Trend: Pre-monsoon trend of water level

A perusal of the table shows that there is falling trend in all the wells during Pre-monsoon period. The range of decline is 14 cm/year at Lehdri in Kara block to 68 cm/year at Saraiakil in Newada block.

Table3: DWL Trend during Pre-monsoon period (2003 to 2012)

Sl.No.	No. of wells analyzed	No. of wells showing declining Trend	No. of wells showing decline of				
			10-20 cm/yr	20-30 cm/yr	30-40 cm/yr	40-50 cm/yr	60-70 cm/yr
1.	14	14	1	1	5	3	2

Almost 40% of wells are showing decline in the range of 30-40 cm/year.

Post-monsoon trend of water level

A perusal of the table shows that there is falling trend during Post-monsoon period in all the wells. The range of decline is 0.009 cm/year at Lehdari in Kara block to 1.44 cm/year at Kotari in Manjhanpur block.

Table4: DWL Trend during Post-monsoon period (2003 to 2012)

The general rate of decline is more in Post-monsoon period than in Pre-monsoon period for 2003 to 2012.

SNo	Number of wells analyzed	Number of wells showing declining trend.	Number of wells showing decline of					
			10-20 cm/y	20-30 cm/y	30-40 cm/y	40-50 cm/y	50-60 cm/y	>100 cm/y
1	14	14	4	2	2	3	2	1

4.2 **Ground Water Resource:** The dynamic ground water resources of the district as on 31.3.2009 are given in the following Table:5

DYNAMIC GROUND WATER RESOURCES OF UTTAR PREDESH AS ON 31.03.2009

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	Chail	1869.10	1682.19	2213.09	-530.90	131.76	O.Exploited
2	Kara	5592.25	5033.03	4770.78	00	94.79	Critical
3	Kaushambi	7412.5	6671.25	2724.03	3417.65	40.83	Safe
4	Manjhanpur	5043.12	4538.81	4312.18	00	95.01	Critical
5	Muratganj	4896.68	4407.01	4088.17	00	92.77	Critical
6	Newada	5131.77	4875.18	3774.53	460.72	77.42	S.Critical
7	Sarsawan	9309.98	8378.98	3852.39	3889.98	45.98	Safe
8	Sirathu	5627.72	5346.33	6881.12	1534.79	128.71	O.Exploited
	TOTAL	44883.12	40932.78	32616.29	5702.66	79.68	

The net annual ground water availability in the district ranges from 1682.19 Ham to 8378.98 Ham, minimum being in Chail block and maximum being at Sarsawan block, Gross Ground Water Draft ranges from 2213.09 to 6881.12 Ham minimum in Chail block and maximum in Sirathu block. Net Ground Water Availability for future irrigation development is minimum in Chail block (-530.90 Ham) and maximum in Sarsawan block (3889.98 Ham). Stage of Ground water development in the district is minimum in Kaushambi block (40.83%) and maximum in Chail block (131.76%). Stage of ground water development of the district as a whole is 79.68%.

Of all the blocks in the district only two are safe, Newada falls in semi- critical category, Kara, Manjhanpur and Mooratganj fall in Critical category and Chail and Siathu blocks fall in Over Exploited category. (Since stage of ground water development is high and there is significant decline of post-monsoon water level i.e., 50 cm/year for the period 2003 to 2012.

4.3 Ground Water Quality: Ground water in shallow aquifer, in general, is colourless, odorless and slightly alkaline in nature. The specific conductance ranges from 450 to 1210 $\mu\text{S}/\text{cm}$ at 25°C. Conductance below 800 $\mu\text{S}/\text{cm}$ at 25°C. has been observed in 80% of analyzed water samples.

It is observed that ground water is suitable for drinking and domestic uses in respect of all parameters except Nitrate. The Nitrate ranges from 13 to 66 mg/l. About 40% of water samples have high concentration of NO_3 (>45 mg/l). The high content of NO_3 is due to return seepage from irrigated land, use of excess fertilizers and improper waste disposal, Fluoride ranges from 0.4 to 2.6 mg/l.

4.4 Status Of Ground Water Development:

Development of ground water in the district is mainly through dug wells, Hand Pumps – India Mark-II and Tube wells. The gross ground water draft for irrigation in the district as on 31.3.2009 is 294.76MCM whereas the ground water draft for domestic and industrial use is 31.36 MCM. Hence the existing gross ground water draft for all uses in the district is 326.12 MCM. Net Ground Water Availability for future irrigation development in the district is 57.02 MCM. A quantum of 57.53MCM has been allocated for domestic and industrial requirement for next 25 years (2033). Net available ground water availability in the district is 409.32 MCM. The stage of ground water development for the district is 79.68%. Of all the blocks in the district only two are safe, Newada falls in semi- critical category, Kara, Manjhanpur and Mooratganj fall in Critical category and Chail and Siathu blocks fall in Over Exploited category.

Water Supply based on ground water sources

U.P. Jal Nigam is the government agency responsible for providing drinking water supplies to the urban and rural population in the district. The water requirements of the habitants are met with through surface water sources or through various mini water supply schemes or integrated water supply schemes utilizing the available ground water resources.

There are many shallow and deep tube wells through which water is supplied through pipe lines/taps in the urban areas of the district.

In the rural areas of the district there are 742 no. of villages in which water is supplied by Tap/Hand Pump India Mark II, benefiting 23,01,094 population as per data of 2010-11.

5. Ground Water Management Strategy:

5.1 Ground Water Development

In Kaushambi and Sarsawan blocks, the level of development is <50%. In these blocks there is scope of ground water development with proper management and control.

In the blocks of high level of ground water development (>70%) covering major parts of the district it is necessary to exercise caution while planning further development of available ground water resources in the district.

In the areas of low ground water development the wells suitable for extraction of ground water, suitability of rigs, depth range and discharge in the district can be summarized as follows:-

Sl.No,	Wells feasible	Rig suitable	Depth of well (m)	Discharge (lpm)
1.	Dug well/Hand Pump	Manual/ Hand Boring set	20-40	50-100
2.	Shallow Tube well	Rotary Rigs (Direct/Reverse)	50-120	1500-2000
3.	Deep Tube well	Rotary Rig	150-280	2000-4000

5.2 Water Conservation & Artificial Recharge

In the areas where post-monsoon depth to water level is more than 8 mbgl and rate of decline during post-monsoon period is 72 cm/year, there is immediate need to adopt techniques of water conservation and artificial recharge.

In such urban area, roof top rain water harvesting should be made mandatory for all government buildings, schools etc. Recharge Pits/shafts/trenches of suitable design are ideal structures for rain water harvesting in such areas. Central Ground Water Board provides free technical guidance for implementation of roof top rain water harvesting schemes.

In rural areas check dams, Cement Plug should be constructed as per local hydro geological conditions to recharge the area. Revival, Renovation and Restoration of Ponds should be encouraged to arrest the decline of water level.

6. Ground Water Related Issues and Problems:

The trend analysis of historical ground water level data indicate fall both in Pre and Post-monsoon period in the major parts of the district. This will impact in:-

- (i) further decline of ground water level
- (ii) drying up of dug wells/shallow wells
- (iii) decrease in yield of Tube wells, and
- (iv) Increased expenditure and power consumption for drawing water from progressively deeper depths.

SOIL ALKALINITY/SODACITY:

Alkaline efflorescence is wide spread in the northwestern and southeastern parts of Kaushambi district, mostly in the area lying between Ganga River and Sasror Khadri River.

7. Awareness & Training Activity:

Central Ground Water Board has not conducted any Mass Awareness Programme and Water Management Training programme in the district. In Chail and Sirathu blocks which falls in Over Exploited category both these programmes should be done in the future.

8. Areas Notified by Central Ground Water Authority:

Central Ground Water Authority has not notified any area/block in the district.

9. Recommendations:

1. as level of development in many blocks of the district is high, further development of ground water should be arrested in these areas, especially in Chail and Sirathu block which falls in Over Exploited category.

2. Artificial recharge technique should be adopted in the district due to occurrence of deep water condition to arrest the decline of water level. In urban areas, roof top rain water harvesting, with structures such as Recharge pits/shafts/trenches of suitable design, should be made mandatory for all government buildings, schools etc. having large roof top area.

3. All the blocks are exhibiting declining trends in their ground water level hence proper vigilance and regular monitoring of water levels at close intervals through suitably located structures is essential.

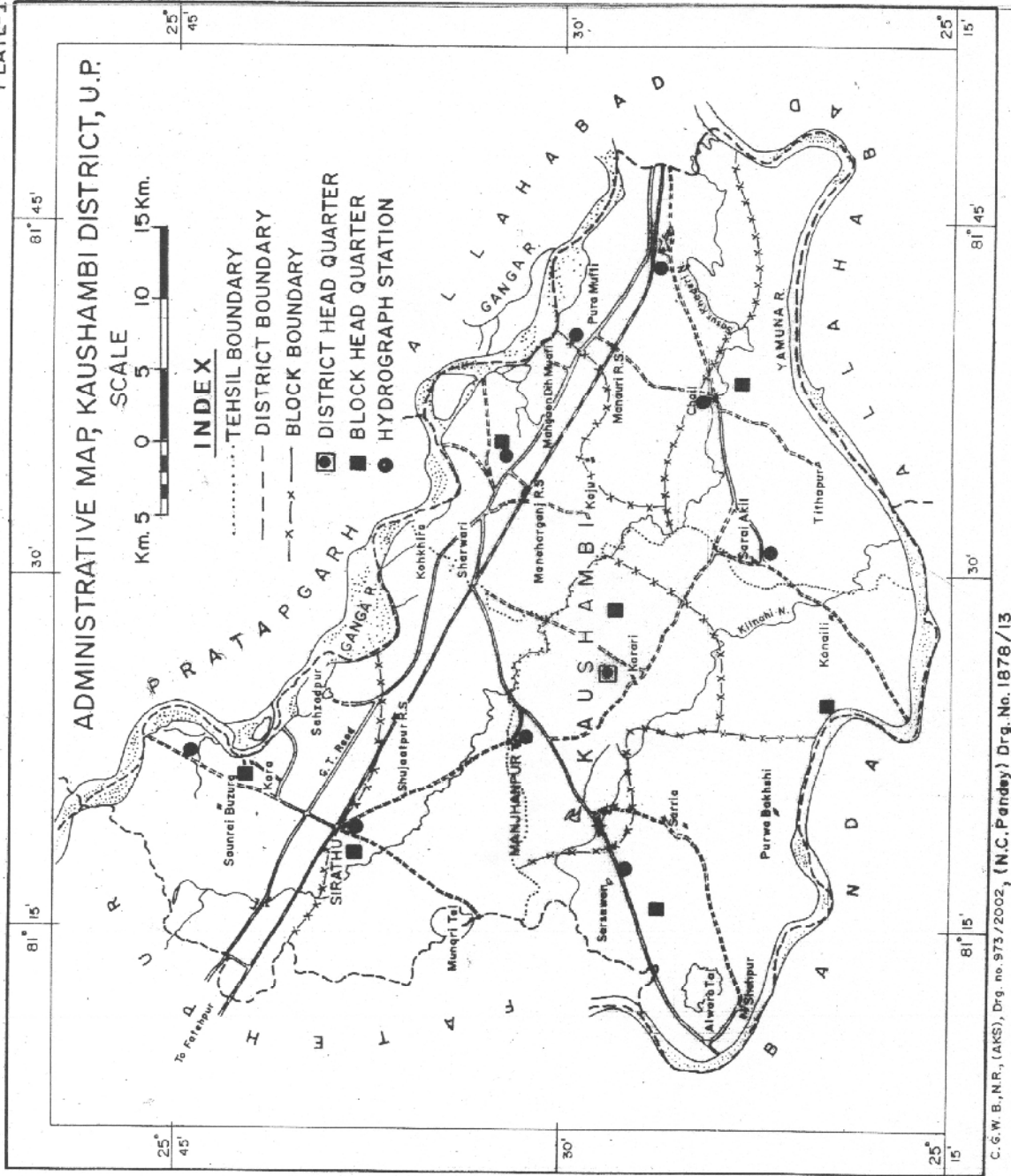
4. To minimize the over stress on Aquifer Group-I, it is advisable to plan heavy duty water supply tube well for future all uses by exploiting the Ground water from the deeper aquifer.

5. Efforts should be made to reclaim the barren land resulted due to saline efflorescence for agriculture purpose. The area of shallow ravines is reclaimable for cropping.

6. Excessive use of fertilizers by the farmers should be discouraged particularly in blocks showing high nitrate concentration.

References:

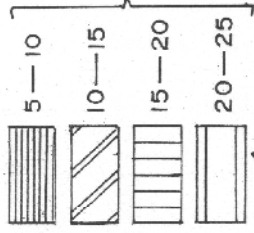
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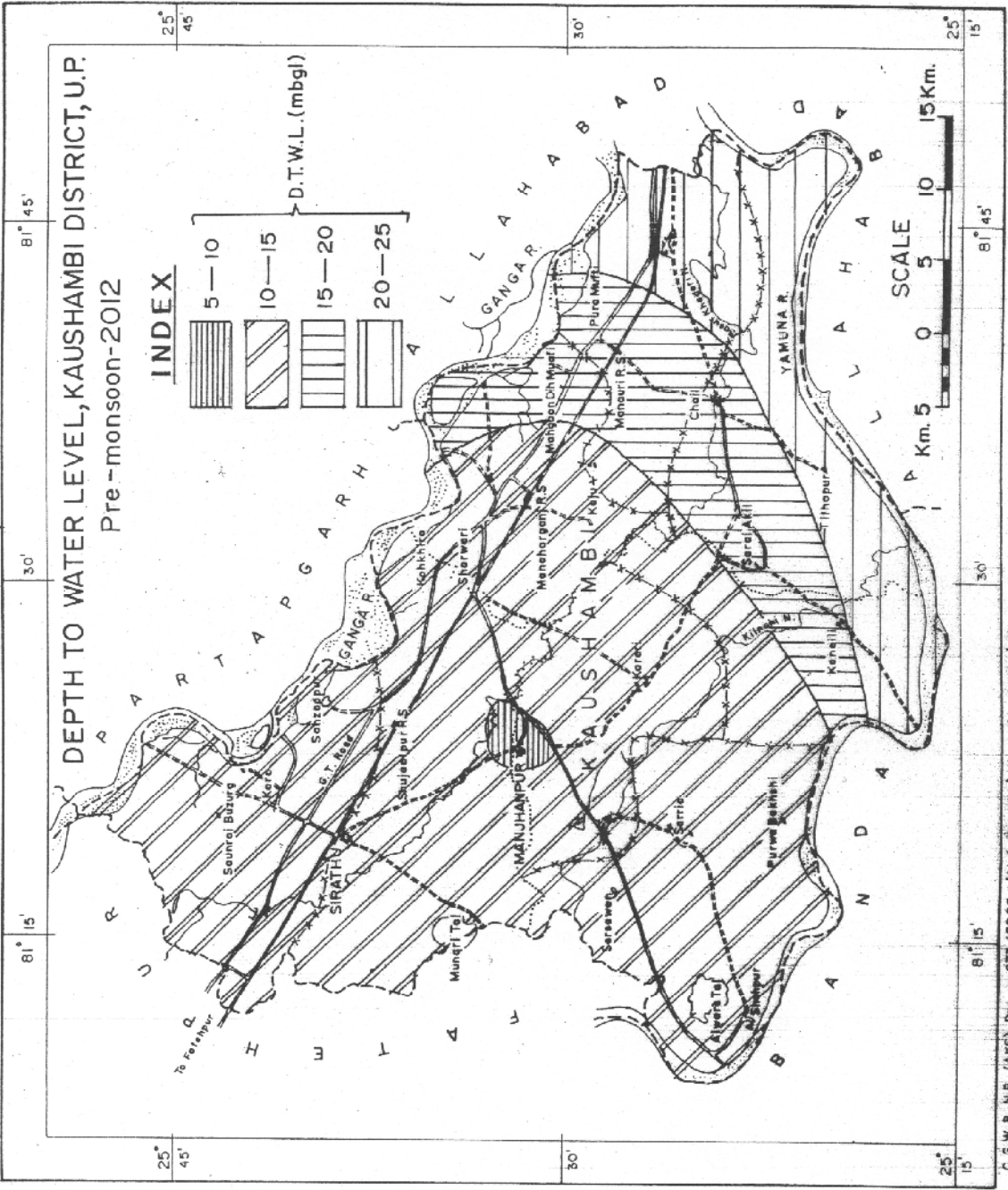
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DEPTH TO WATER LEVEL, KAUSHAMBI DISTRICT, U.P. Pre - monsoon-2012

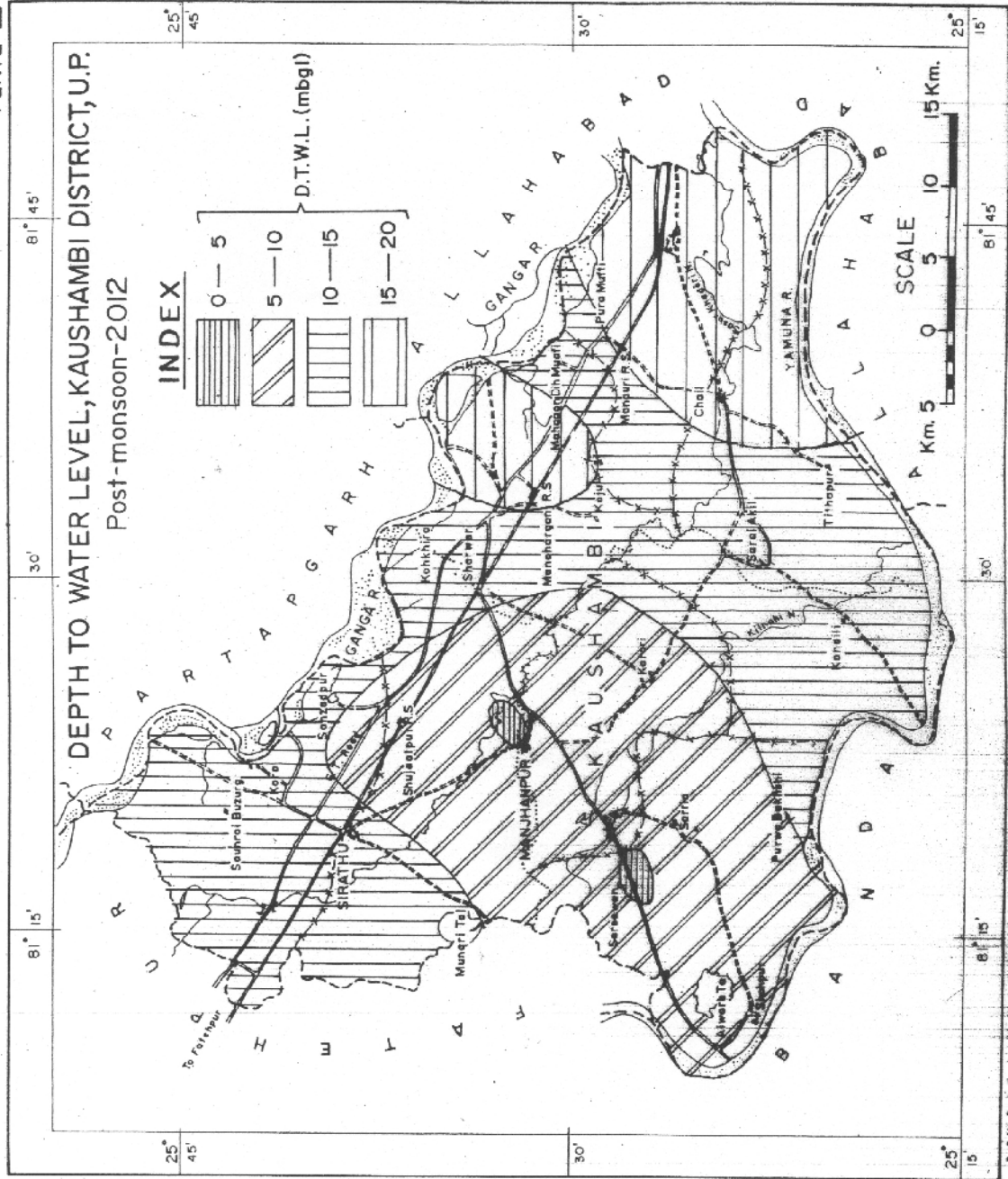
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D.T.W.L. (mbgl)



DEPTH TO WATER LEVEL, KAUSHAMBI DISTRICT, U.P. Post-monsoon-2012

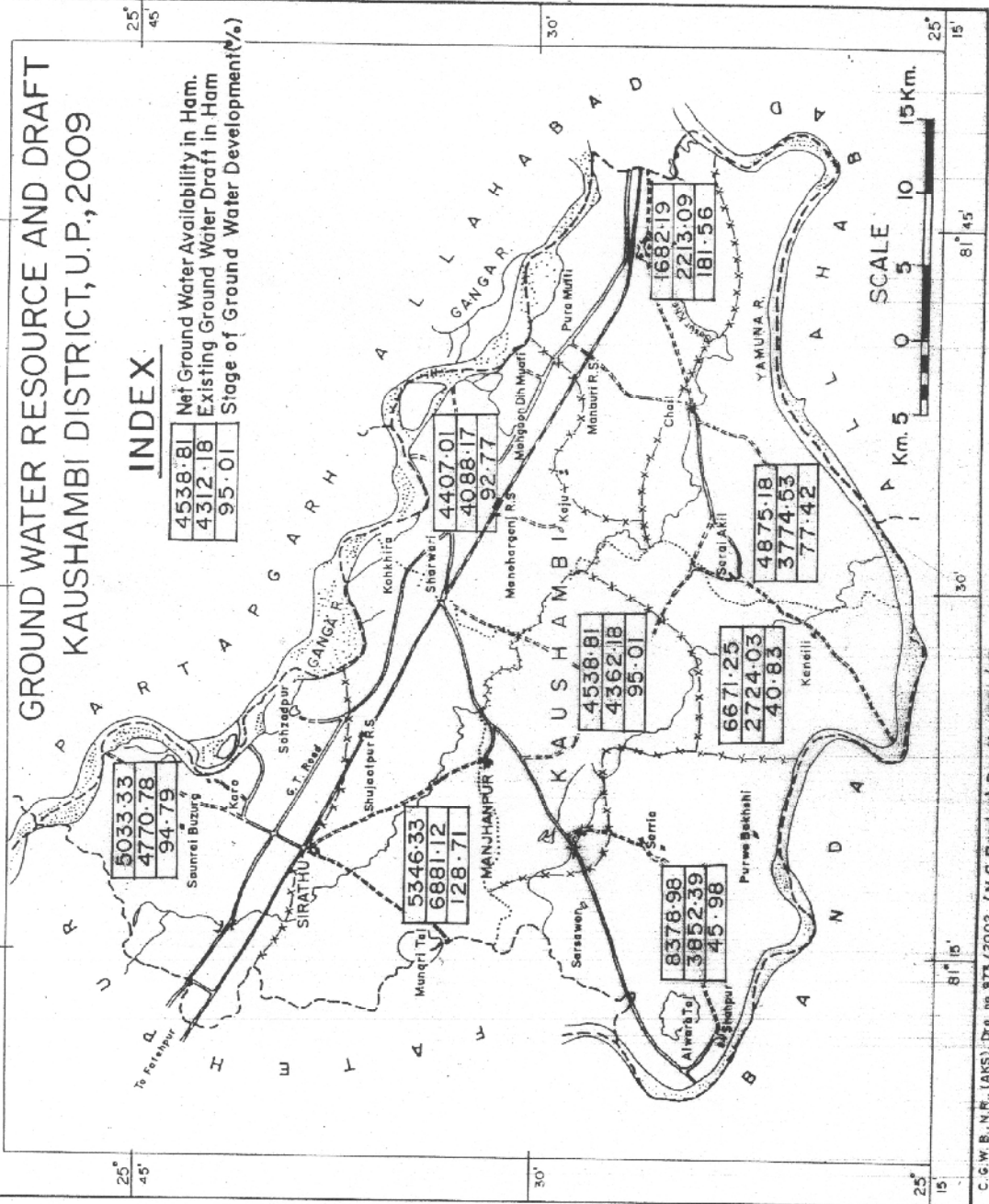


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GROUND WATER RESOURCE AND DRAFT KAUSHAMBI DISTRICT, U.P., 2009

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4538.81	Net Ground Water Availability in Ham.
4312.18	Existing Ground Water Draft in Ham
95.01	Stage of Ground Water Development (%)



C.G.W.B., N.R., IAKS; Drg. no. 973/2002, (N.C. Pandey) Drg. No. 1861/13