

GROUND WATER INFORMATION BOOKLET

MAHARAJGANJ DISTRICT, U.P.

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

By

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DISTRICT AT GLANCE

1. GENERAL INFORMATION

i. Geographical Area (Sq. Km.)	: 2984
ii. Administrative Divisions (As on 2007-08)	
Number of Tehsil / Block	: 4/12
Number of Panchayat / Villages	: 777/1258
iii. Population (as on 2001 census)	: 11,24,290
iv. Normal Annual Rainfall (mm)	: 1327.7

2. GEOMORPHOLOGY

Major Physiographic Units	: Older and Younger Alluvium
Major Drainages	: Rapti and Gandak river

3. LAND USE (Sq.Km.)

a) Forest area	: 449.02 Sq.Km.
b) Net area sown	: 2018.53 Sq.Km.
c) Cultivable area	: 2018.53 Sq.Km.

4. MAJOR SOIL TYPES : Transported soil

5. AREA UNDER PRINCIPAL CROPS (as on 2007-08) : Rabi, Kharif and Jayad

6. IRRIGATION BY DIFFERENT SOURCES

(Areas and Number of Structure)

Dugwells	: 20.56 Sq.Km.
Tubewells / Borewells	: 14.91 Sq.Km. / 1274.81 Sq.Km.
Tanks/ponds	: 18.82 Sq.Km.
Canals	: 326.49 Sq.Km.
Other Sources	: 0.13 Sq.Km.
Net Irrigated Area	: 1660.00 Sq.Km.
Gross Irrigated Area	: 1880.00 Sq.Km.

7. NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2007)

No. of Dugwells	: 9
No. of Piezometers	: Nil

8. PREDOMINANT GEOLOGICAL FORMATIONS : Gravel, Sand, Clay & Kankar

9. HYDROGEOLOGY

Major water bearing formation	: Gravel, Sand, Unconfined &
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Confined Aquifers

Pre-monsoon Depth to water level during 2007 (mbgl) : 1.79 to 5.13
Post-monsoon Depth to water level during 2007 (mbgl) : 1.14 to 2.37
Long term water level trend in 10 years (1998-2007) in m/yr : Rise 0.0135 to 0.0930
Fall 0.0802 to 0.0816

10. GROUND WATER EXPLORATION BY CGWB

(As on 31-3-2007)

No of wells drilled (EW, OW, PZ, SH, Total) : EW-7, OW-12
Depth range (m) : 308.55 to 450.00 mbgl
Discharge (litres per second) : 1895 to 2270 lpm
Storativity (S) : 2.3×10^{-4}
Transmissivity (m^2/day) : 900 to 2320 m^2/day

11. GROUND WATER QUALITY

Presence of Chemical Constituents more than : Within permissible limit
permissible limit (e.g. EC, F, As, Fe)

Type of water : Good

12. DYNAMIC GROUND WATER RESOURCES

(2004)-in MCM

Annual Replenishable Ground Water Resources : 1256.0455 mcm

Net Annual Ground Water Draft : 5256.59 mcm

Projected Demand for Domestic and Industrial Uses : 75.3638 mcm
upto 2029

Stage of Ground Water Development : 45.87%

13. AWARENESS AND TRAINING ACTIVITY

Mass Awareness Programmes organized : Nil

Date

Place

No. of participants

Water Management Training Programme organized : Nil

Date

Place

No. of participants

14. EFFORTS OF ARTIFICIAL RECHARGE & : Nil

RAINWATER HARVESTING

Projects completed by CGWB (No & Amount spent) : Nil

Projects under technical guidance of CGWB (Numbers) : Nil

15. GROUND WATER CONTROL AND REGULATION :

Number of OE Blocks : Nil

No of Critical Blocks : Nil

No of blocks notified : Nil

16. MAJOR GROUND WATER PROBLEMS AND ISSUES : Water logging and flood prone

GROUND WATER INFORMATION BOOKLET

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1.0. INTRODUCTION

LOCATION AND AREA:

The district Maharajganj occupying the extreme north eastern part of the state lies between 26⁰53'20" and 27⁰28'37" N latitude and 03⁰07'03' and 83⁰56'30" E longitude and falls in the survey of India Degree Sheet No. 63 M and N. The total geographical area of district is 2934.1 sq. km. The district has been bounded by Nepal in north, Gorakhpur in south, Siddharth Nagar in west and Deoria in north. There are five tehsils and 12 development blocks and 103 Nyay Panchyats and 759 Gram Sabhas. Maharajganj is the headquarter of this district.

GROUND WATER BASIN:

The area of the district Maharajganj is a part of the Central Ganga Plain and is underlain by quaternary alluvium of Pleistocene to sub-recent age.

DRAINAGE:

The drainage system is controlled by Rapti and the Gandak rivers in the district. The main tributaries of Rapti are Ghoghi river, Rohini river and Pharenda Nala. The great Gandak or Naryani river the another major river system, takes its rise in the snowy ranges of Nepal and leaves the hills by the gorge near Tirvenighat, about 16 Km. North of the boundary of Maharajganj district. The river is known as Naryani in India and in Nepal as Saligrami. Poh, Piyas, Mahau, Madao, Baua, Chilva Basmans are minor tributaries in the district.

Besides, the above major rivers in the district, there are number of perennial lakes. The major lakes of the district are Darhia Tal, Senia Tal, Poh Tal, Sarua Tal etc. These lakes are sources of Fish as well as sources of minor irrigation in the district.

IRRIGATION PRACTICES:

The irrigation is being done by ground water and surface water through canals, ponds, tanks etc. The present of net irrigated area (1655.72 Sq. Km.) with net area sown (2018.53 Sq. Km.) is %. The share of ground water in net irrigated area is 78% carried out by Central Ground Water Board (C.G.W.B.).

STUDIES OF C.G.W.B.:

C.G.W.B. has completed systematic hydrogeological survey and Ground Water Management Studies are being carried out periodically. Apart from this, ground water exploration has been carried out to delineate the aquifer geometry, potentiality and to know aquifer characteristics. Special attention has been given to identify the auto flow conditions in various aquifers, the specific design for construction of tubewells, adopting cement sealing techniques and auto flow zones tubewells.

2.0 RAINFALL AND CLIMATE

RAINFALL:

The normal rainfall is of tune of 1327.7 mm.

CLIMATE:

The climate is sub-humid to humid and is influenced to some extent by the proximity of the north and the existence of tarai swamps. About 87% of the rainfall takes place from June to September. January is the coldest month with daily maximum temperature at 23⁰C and the mean daily minimum temperature at 9.9⁰C. May is the hottest month with mean daily maximum temperature is 39⁰C and the mean daily minimum temperature is 25.9⁰C. With the onset of monsoon day temperature drops appreciably but nights continue to be warm. The mean monthly

maximum temperature is 31.9⁰C and mean monthly minimum temperature is 19.8⁰C. During the monsoon and postmonsoon the relative humidity is high and decreases in winter months. The mean monthly morning relative humidity is 69% and mean monthly evening relative humidity is 53%. The mean wind velocity is 4.1 Km/h. The potential evapotranspiration is 1422.7 mm.

3.0 GEOMORPHOLOGY & SOIL TYPES

GEOMORPHOLOGY:

Based on the map prepared by Remote Sensing Application Centre, Lucknow using IRSIA imaging and survey of India toposheets the following geomorphic units have been identified-

- (i) Sand bar
- (ii) Flood plain
- (iii) Alluvium plain
- (iv) Ravines
- (v) Older meander
- (vi) Ox bow lakes

SOILS:

The soils of the district are mainly transported i.e. alluvial comprising sand, silt and clay in varying proportions and are rich in humus. The alluvial soils of the district are subdivided into older alluvial soil and younger alluvial soil. The older alluvial soil occupies high land while the younger soils are restricted to marginal tract of the little Gandak river. Both of these soils are fertile.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

The district falling under Central Ganga Plain is underlain by quaternary alluvium of Pleistocene to sub-recent age. The deposition in this district took place by

Indo-Gangetic river system (Rapti and Gandak rivers). The northern parts adjoining the Nepal border constitutes Tarai formation having predominance of finer sediments like silt and clay with lensebeds of coarse at depth. Exact thickness of this is not known but it is expected to be considerable since in few boreholes drilled by CGWB down to 450 mbgl bed rock was not encountered. The area south of Tarai formation is formed by alluvial plain where proportion of sand percentage is more than clays. The alluvial deposits consist of silt, clay mixed with kankar, gravels and sands of various grades in varying proportions.

The alluvial deposits are broadly classified under two categories (1) Older (2) Younger alluvium. The older alluvium deposits known as “Bangar” or high sand soils are liable to denudation. The Bangar can be further subdivided into three subcategories on the basis of percentage of sand content viz Balua containing more than 70% silica, loam containing silica about 50% and Matiar containing less than 40% silica. The younger alluvial deposits known as “Kachchar” occupy the marginal tracts of little Gandak, Ghongi Nadi and other third order streams. It consists of sand clay, sand along the river tract and clay silt in the gentle sloping plain. Exploratory drilling carried out by C.G.W.B. in the district in the depth range of 308.55-450.88mbgl show existence of thick pile of alluvial sediments comprising clay, silt, sands of various grades, gravels and occasional kankar. Broadly three tier aquifer system exists in the area.

Aquifer Group – I

Aquifer Group – II

Aquifer Group - III

Ground water occurs both under unconfined and confined conditions. The principal source of replenishment of ground water is precipitation. Auto-flow conditions have been encountered in the aquifer in the northern part of the district along Indo-Nepal international boundary. C.G.W.B. with aim to identify spatial, disposition of aquifer under auto flow condition, potentiality and sustainability of underlying aquifer drilled three exploratory boreholes at Trilokpur, Nepania and Thutibari down to 441, 350 and 450 mbgl respectively. The hydrostatic head of these wells were recorded to be 4.0, 3.6 and 0.15 m.a.g.l. respectively.

4.2 WATER LEVELS (Pre-Monsoon and Post-Monsoon):

During pre-monsoon water level ranges from 1.65 to 6.99 mbgl and in post-monsoon from 1.00 to 5.00 mbgl. The depth to water level maps both for pre-monsoon and post-monsoon periods have been prepared. 60 to 65% of area is under 0.00-3.00 mbgl indicating adequate recharge due to monsoon and under water logging condition.

The ground water in the shallower zone occurs under the unconfined conditions. However in the deeper zone it occurs under semi-confined to confined conditions. Ground water flow is towards Rapti and little Gandak Which is flowing north south direction. The four blocks MAHARAJGANJ, Nichloul, Partawal and Thalkulwa block show declining trend from 0.0059 to 0.0773 m/year and maximum at Thakulwa which show rising trend from 0.0061 to 0.1738 m/year.

Aquifer characteristics:

The ground water exploration has revealed the presence of confined aquifer system with auto flow conditions in the northern parts of district along Indo-Nepal international boundary. C.G.W.B. has taken up a programme to identify the spatial disposition of aquifer under flowing conditions their potentiality and sustainability with probable hydrogeological reason for such conditions. Three bore holes at Trilokpur, Nepanua and Tulhibare were drilled down to the 441 m, 350 m and 450mbgl respectively. The hydrostatic head of these wells recorded 4.6 magl, 3.00magl and 0.15 magl respectively. The shallow tubewells in the district down to depth of 50 m can be constructed through straight assembly of 250 mm dia with 20 m length of slotted pipe of 1.50 mm slot size. The annular space between borehole and well assembly should be surrounded by 3 to 6 mm pea gravel of preferably 100 to 120 mm thick zone. Such tubewells are expected to yield 50 to 75m³/hr at economic drawdown. The tubewells of high to moderate yield down to 200 m depth can be constructed through 300 / 200 mm dia well assembly with around 50 m housing depth. These tubewells require 50 to 60 m, saturated granular zone to be tapped with 1.50 mm slot size. The expected yield of such deep tubewells would be around 90 to 180 m³/hr at drawdown of 5 to 10 m. The deep tubewell in the district also require to be gravel packed, the gravel size of 3 to 5 mm are desirable to develop 100 to 120 mm thick zone around the tubewell assembly. The transmissivity of aquifer varies from

330 to 2395 m²/day, the permeability varies from 9.8 to 79.8 m/day. The deeper aquifer are confined in nature having storage coefficient of an order of 2.3×10^{-4} .

4.3 GROUND WATER RESOURCES:

The dynamic ground water resources of MAHARAJGANJ district has been estimated jointly by CGWB and Ground Water Department, U.P. following the norms laid down by “GEC, 1997 Methodology” as on 31-03-04.

The estimated figures are as under:

Annual Ground Water Recharge	-	125604.55 ham
Net Annual Ground Water Availability	-	114607.26 ham
Existing Gross Ground Water Draft for All Uses	-	52565.96 ham
Net Ground Water Availability for Future Irrigation	-	59050.39 ham
Stage of Ground Water Development in	-	45.87%
Allocation for Domestic and Industrial Water	-	7536.58 ham
Supply Requirement upto 25 years		

4.4 GROUND WATER QUALITY:

The quality of ground water in MAHARAJGANJ district is good for drinking and irrigation purposes. The results of chemical analysis show the following range of variations in chemical constitutes in the ground water.

pH	-	0.00-8.20
Specific Conductance (EC)	-	140 to 1480 microsiemen/cm at 25 ⁰ C
Chloride	-	7.1 to 213 mg/l
Carbonate	-	Nil
Bicarbonate	-	61 – 647 mg/l
Calcium	-	8 to 124 mg/l
Magnesium	-	4.9 to 46 mg/l
Total Hardness	-	60 to 440 mg/l
Sodium	-	5.1 to 165 mg/l
Potassium	-	0.4 to 165 mg/l

The sodium percentage of ground water in the district ranges from 9.94 to 79.2% indicating sodium hazard free ground water in the district except at Kasmaria (Mithran Block), Derwa (Partwal Block), Sampatia (Nautnawa Block), Sonbarsa (Pharenda Block), Garaura (Nichlaul Block) Har Khapyas (Gughuly Block). SAR

values in the district range from 0.92 to 27.00 indicating excellent class of water at all depths in the district except Kasamaria, Baredwarika, Derwa, Sampatir, Sonbarsa, Gasaura areas. The water containing more than 40 mg/l of bicarbonates, more than 40mg/l sulphates, or 40 mg/l of silicates can be considered incrusting. The incrustation caused due to precipitation of bicarbonate are soft and can be easily removed by acid and other chemicals. On the basis of these parameters the ground water around Derwar and Balarai in Partawal block, Sampatia and Nautanwa in Mautnawa block, Sonbarsa in Pharenda block, Garaura in Nichlaul block has water of soft incrustation. Thus wells in the area may be treated with acid periodically even if the failure symptoms have not noticed.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 GROUND WATER DEVELOPMENT:

At present ground water development in this district is mainly controlled by the shallow tubewells along with some deep tubewells which are very less in number. As per the estimates of ground water resources for the year 2003-04. The net ground water availability is of the order of 114607.26 ham. About 52565.96 ham is being withdrawn for different purposes which is about 55%.

Estimation of ground water has been calculated based on the data of shallow tubewells tapping the unconfined aquifers only. But there are sufficient deep tubewells existing in the district tapping the confined aquifers which are being utilized for pipe water supply and irrigation also. Thus development through deeper aquifers (auto flow) may be taken up by constructing deep tubewells in the northern part of the district.

5.2 WATER CONSERVATION & ARTIFICIAL RECHARGE:

No structure has been constructed by C.G.W.B. so far in this district.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS

(1) Ground Water Quality Problem:

The high content of nitrate in water may be due to direct flow of sewage with surface water into ground water. A nitrate content exceeding 50 mg/l according to

CSWPCB 1952 and UNESCO 1963 is consider harmful to infants and can cause a disease cyanosis. The nitrate content in ground water of dugwell zone in the district ranges from 0.3 to 25 mg/l. Although at present on the point of view of nitrate there is no indication of pollution of ground water. But now a days promotion of low cost Katcha latrines in the area may lead to the problem of ground water pollution.

C.G.W.B. has constructed 7 deep tubewells which are handed over to State agencies to supply water. Apart from this State government and other agencies has constructed shallow to deep tubewells which are free from any pollution.

(2) Water Logged Areas:

Water logging problems have been observed in parts of Nichlaul, Nautnawa, Laxmipur, Paniyara and Partwal blocks are under water logging condition because depth to water level is below 3.00 m.

(3) Area having Decline in Water Level:

From the long term monitoring of water level, declining trend has been observed in some parts of the districts.

(4) Drilling Problem:

In some areas, it is observed that deep aquifers are not found within 400 mbgl particularly in the northern part of the district due to presence of heavy boulders.

(5) Risk to Natural Disasters:

The natural erosion along the banks of the Gandak and Rapti rivers causing huge loss of agricultural and residential land especially in rainy season is a serious problem in the blocks along the river banks.

7.0 AWARENESS AND TRAINING ACTIVITY

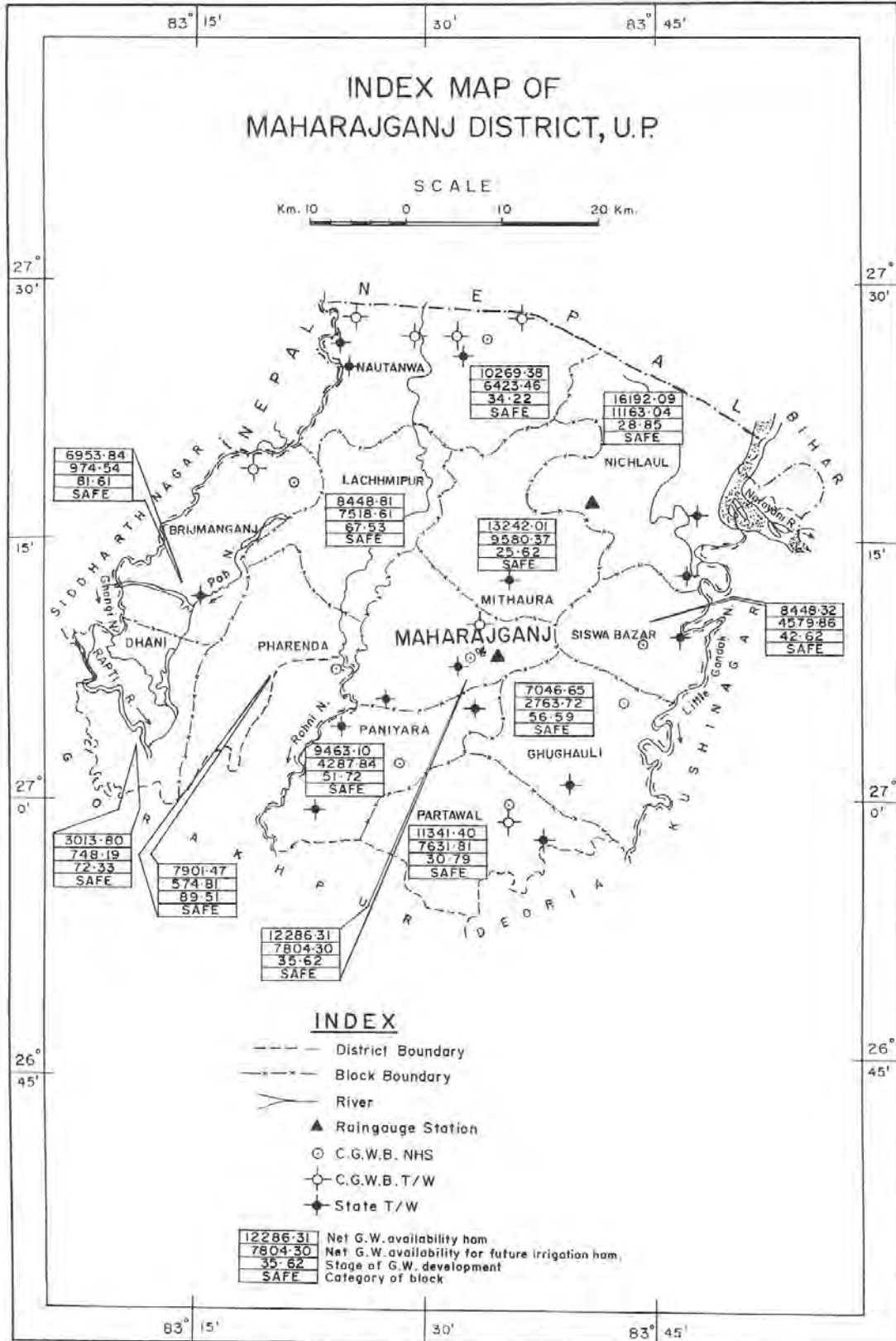
Nil.

8.0 AREAS NOTIFIED BY CGWB

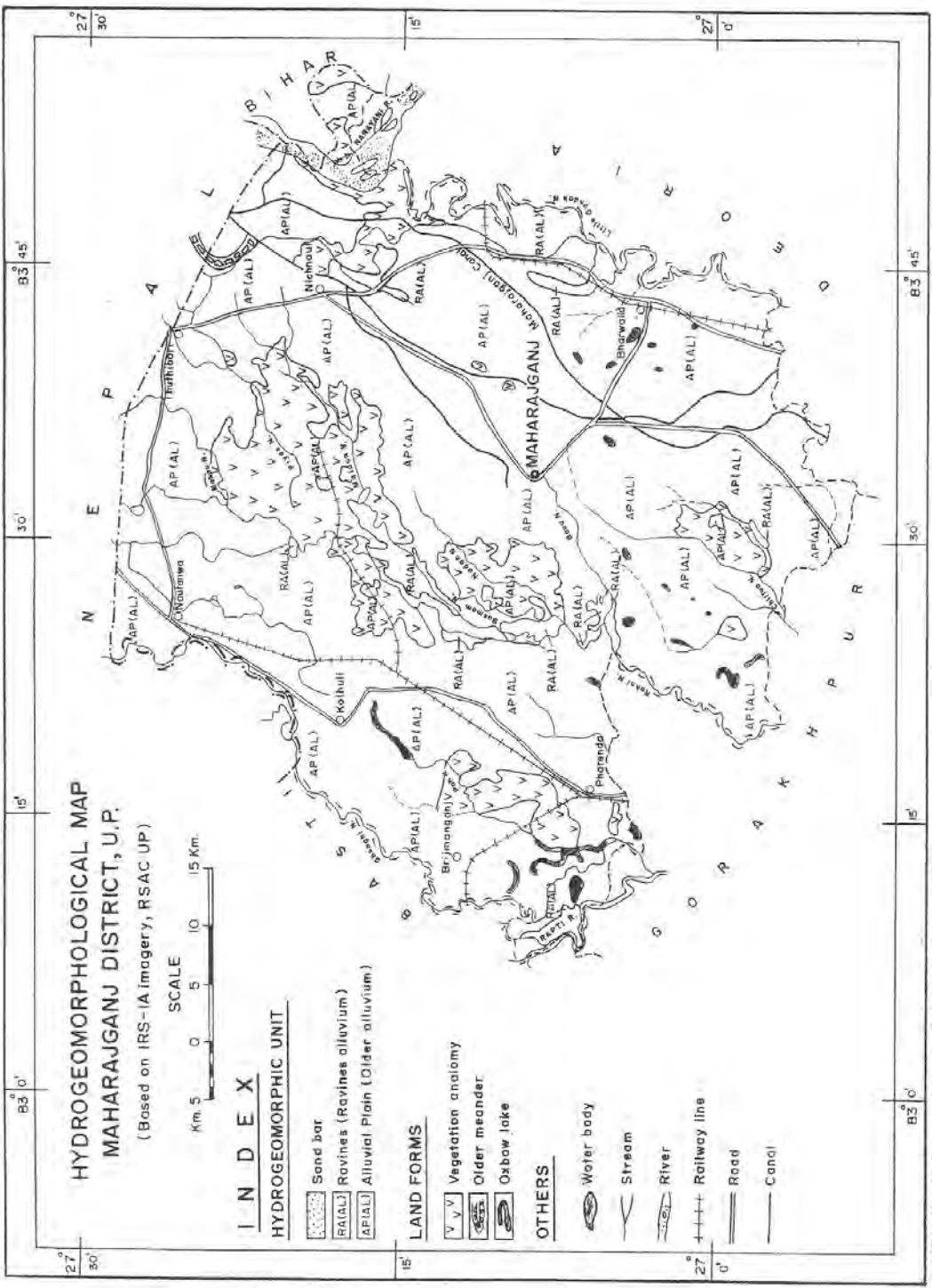
List of area : Nil

9.0 RECOMMENDATIONS

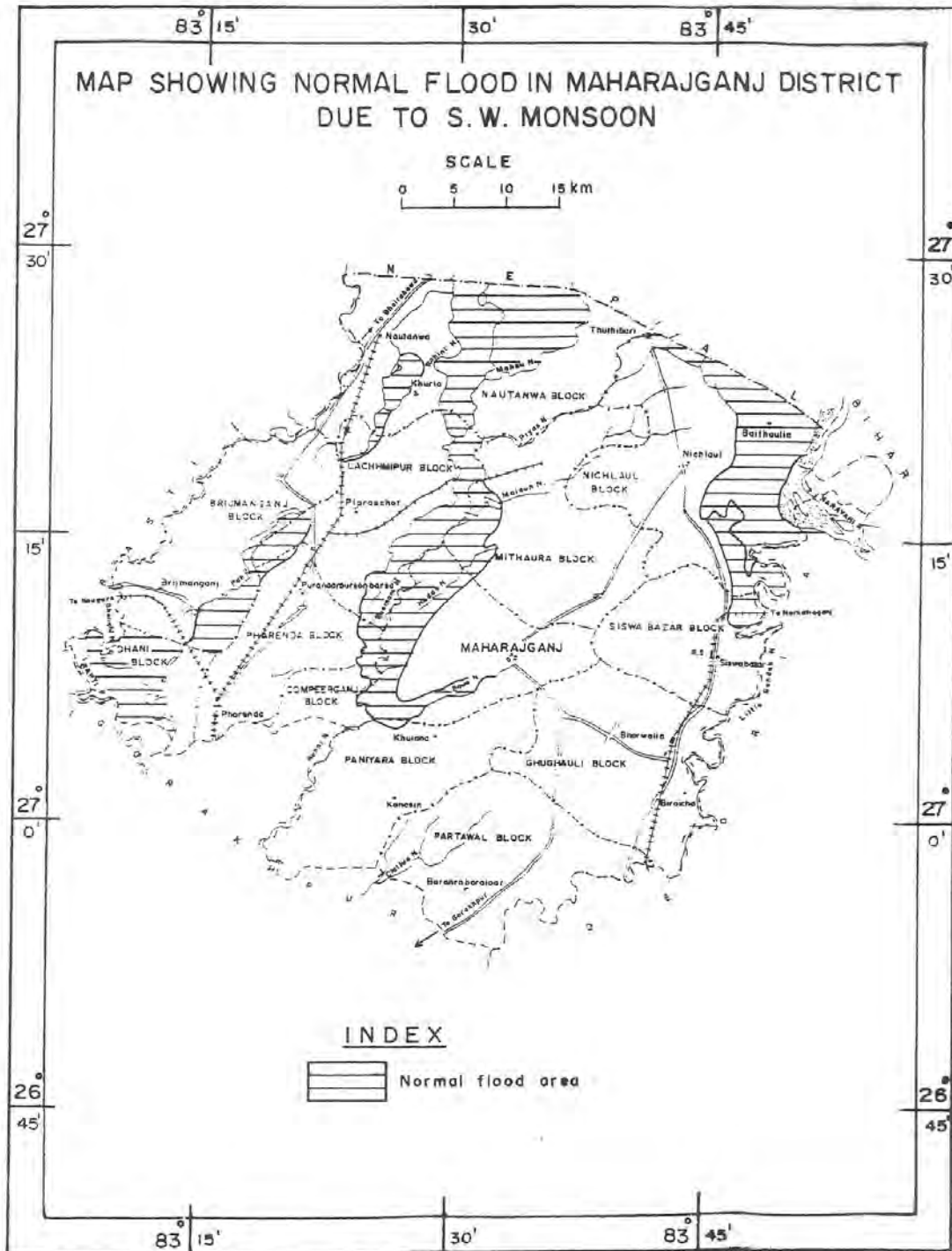
- (a) As indicated by the estimates of ground water resources potential, it is strongly recommended that stress on the use of ground water is given to boost the economy of the district by bringing more agricultural area into irrigation.
- (b) To establish geometry and behaviour of deeper aquifers there should be ground water exploration through deep exploratory drilling in the entire district.
- (c) As indicated above heavy duty tubewells are feasible in the district except in canal irrigated areas in north eastern parts of the district where canal network is running, to avoid water logging in canal command area, shallow tubewells may be constructed to develop the phreatic aquifer so that in future water logging may be restricted.
- (d) In the water logged or prone to logged area such type of crop cultivation might be encouraged which requires more water. The plantation of eucalyptus tree is also beneficial.
- (e) The number of permanent hydrograph stations may be increased near canals and its command to monitor the effect of canals on ground water.
- (f) Geomorphologically, area under flood plains, old meander and near ox-bow lakes are suitable for construction of high discharge tubewells.
- (g) For balance, ground water, additional 2571 state tubewells and 18288 private tubewells are feasible in the district.
- (h) Area around Kasmaria (Mithaura block), Derwa (Partawal block), Sampatia (Nautnawa block), Sonbarsa (Pharenda block), Garaura (Nichloul block) and Harkha Pyas (Ghughuli block) is prone to sodium hazards, constructive measures should be taken up these areas free from sodium hazards.



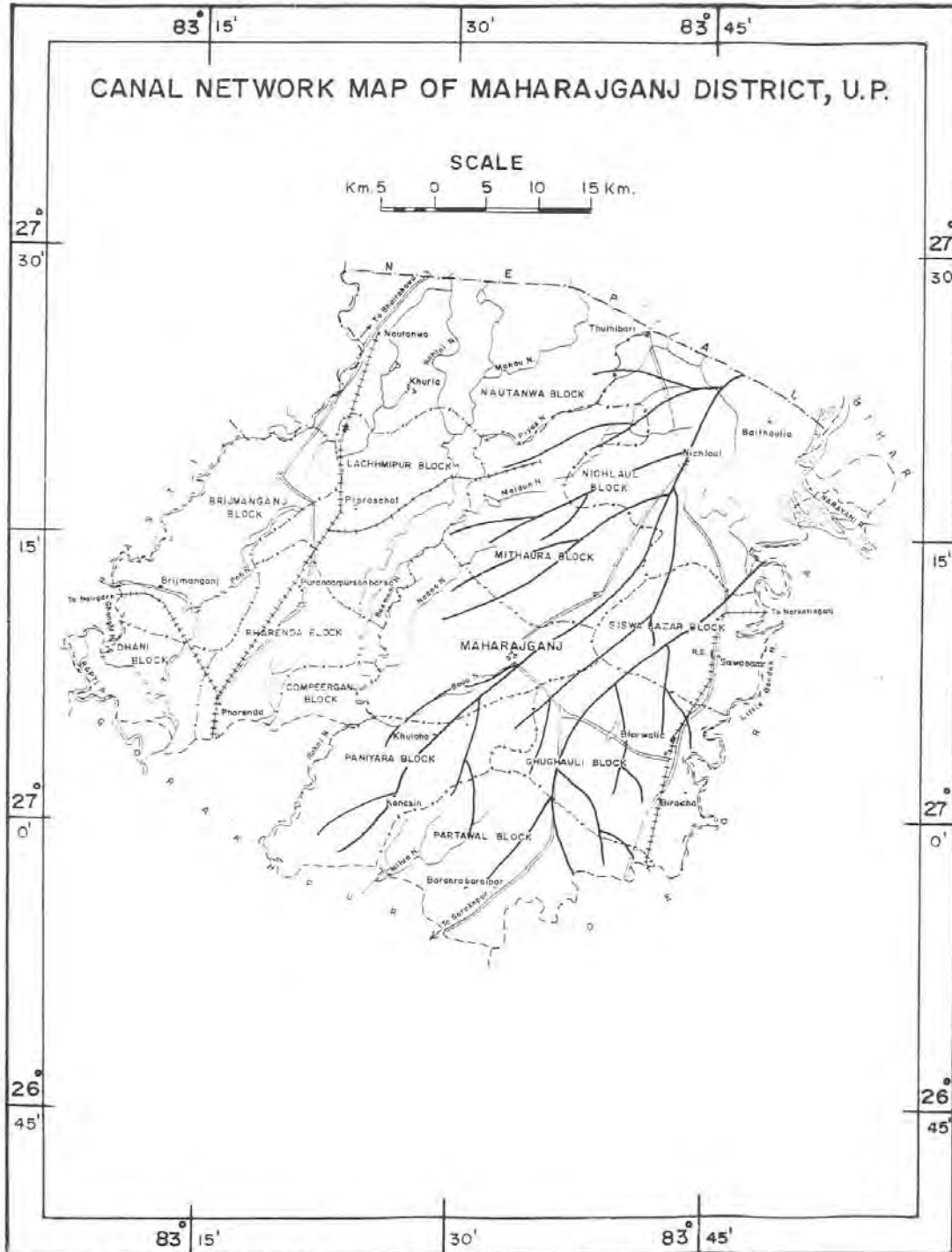
CGWB, NR (N.Chandra) Drg. No. 3971/10 (N.C.Pandey) 3986/10



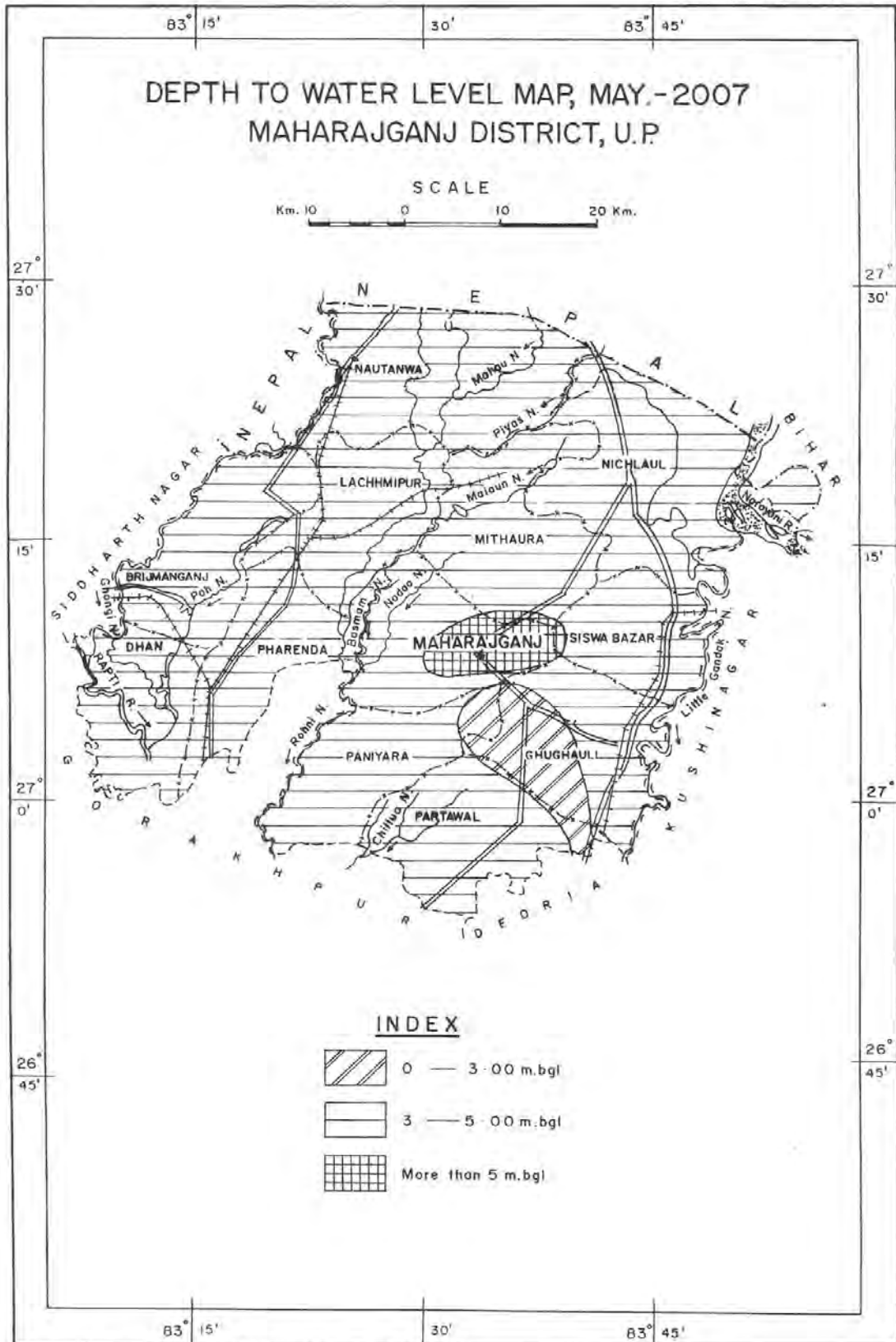
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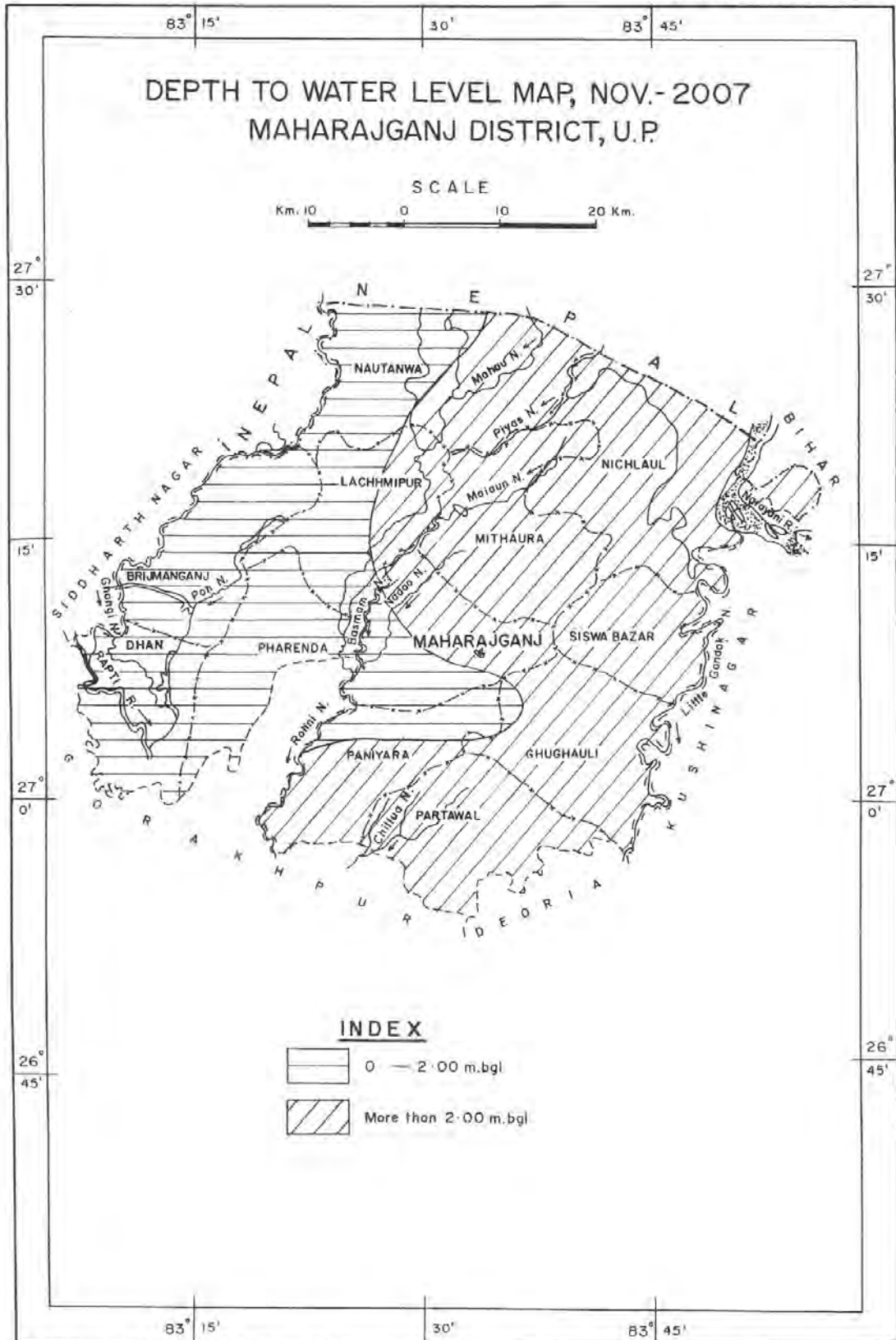


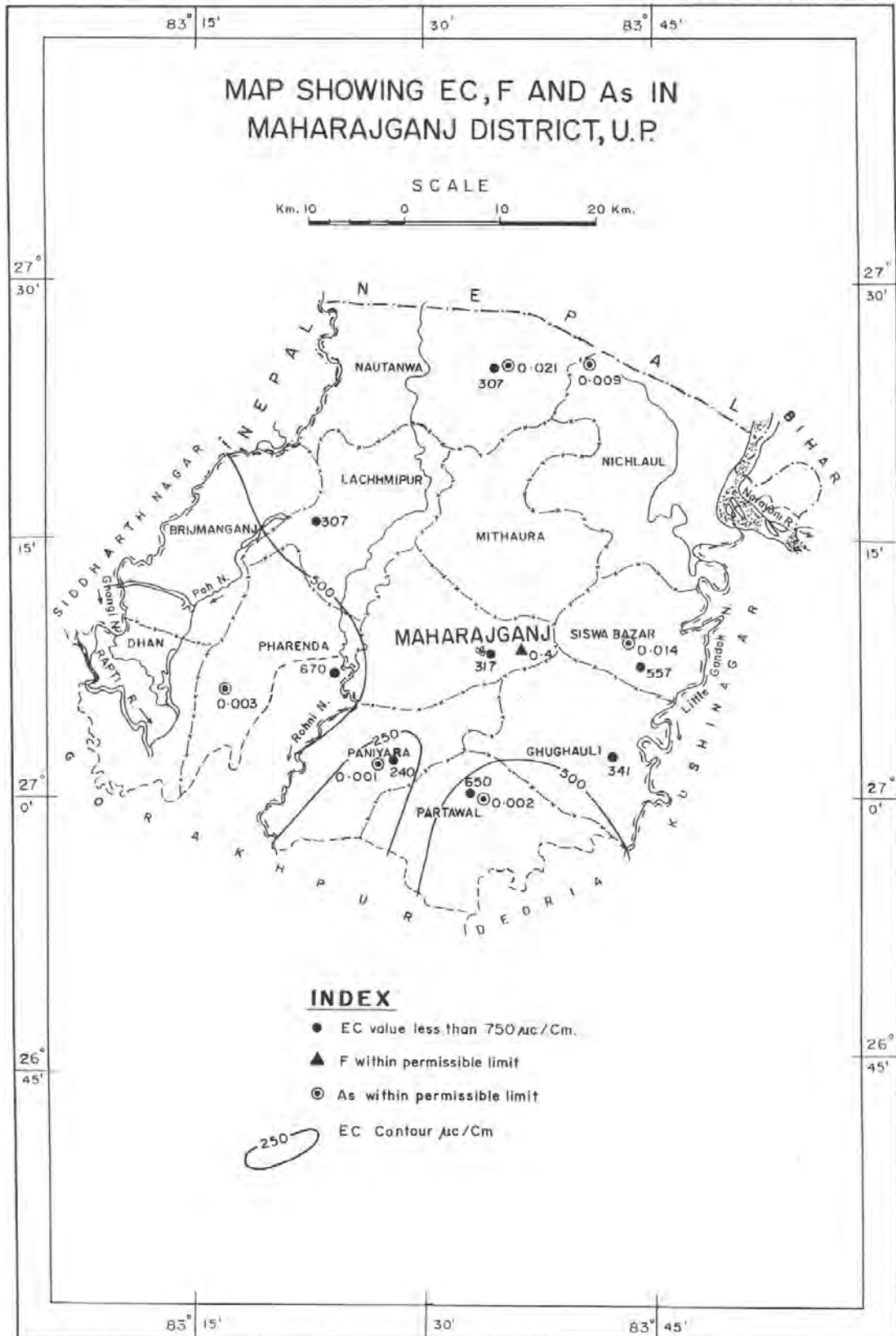
CGWB, NR, Drg. No. 2033/05, 3988/10



C.G.W.B.,NR, Drg.No. 2031/2005, 3989/10







C.G.W.B, N.R (N. Chandra) Drg. No. 3971/10, (N.C. Pandey) Drg. No. 3992/10