

# DISTRICT GROUND WATER BROCHURE OF AURAIYA DISTRICT, U.P.

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## DISTRICT AT A GLANCE (AURAIYA)

### 1. GENERAL INFORMATION

- i. Geographical Area (Sq. Km.) : 2015
- ii. Administrative Divisions (as on 31.3.2005)
  - Number of Tehsil / Block : 2/7
  - Number of Panchayats /Villages : -/841
- iii. Population (As on 2001 census) : 1179993
- iv. Average Annual Rainfall (mm) : 807.35

### 2. GEOMORPHOLOGY

- Major physiographic units : Ganga-Yamuna Doab sub divided in Lowland area (Active & Old flood plain) and Upland area (Varanasi & Banda alluvial plain)
- Major Drainages : Yamuna, Chambal, Sengar, & Rind rivers.

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

- a) Forest area : 102.83
- b) Net area sown : 1438.82
- c) Cultivable area : 1667.15

### 4. MAJOR SOIL TYPES

: Sandy loam and clay, locally classified as Bhur, Matiyar, Dumat and Pilia.

### 5. AREA UNDER PRINCIPAL CROPS (As on 2005-06) : 1342.03

### 6. IRRIGATION BY DIFFERENT SOURCES (Areas in Ha and Numbers of structures) 2005-06

- Dugwells : 11 /-
- Tubewells / Borewells : 2415 / 279  
65572 / 35441
- Canals : 43610 / 826 Km.
- Other sources : 169/-
- Net Irrigated area : 119355
- Gross irrigated area : 177964

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

- Numbers of Dug Wells : 10
- Numbers of Piezometers : Nil

### 8. PREDOMINANT GEOLOGICAL FORMATIONS

: Quaternary Alluvium consisting of mainly sands of various grades, silts, clays and kankar.

- 9. HYDROGEOLOGY AND AQUIFER GROUP** : Multiple granular zones up to 338m depth.
- Major Water bearing formation : Gravel, sand and silt.
- Pre-monsoon Depth to water level during May'2007 : 2.81 - 16.14 mbgl
- Post-monsoon Depth to water level during Nov'2007 : 0.08 - 16.0 mbgl
- Long term water level trend in 10 years (1998-2007) in : Pre-monsoon: Fall (Range 0.002-0.537m) Rise ( 0.009 & 0.017m in two of CGWB wells)  
m/yr : Post-monsoon: Fall (Range 0.056-0.039m) Rise (0.034 & 0.10m in two of CGWB well)
- 10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)**
- No of wells drilled (EW, OW, PZ, SH, Total) : 3 (EW) and 1 (PZ)
- Depth Range (m) : 179.83 m to 338.47 mbgl
- Discharge (liters per second) : 4.53-62.15
- Transmissivity (m<sup>2</sup>/day) : Range from 705.34 to 4623
- 11. GROUND WATER QUALITY**
- Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe) : EC > 2000  $\mu$ siemence/cm at 25<sup>0</sup>C at few places.
- Type of water : In general the quality of ground water is good both for domestic and irrigation purposes. The quality of ground water at places is brackish at deeper levels.
- 12. DYNAMIC GROUND WATER RESOURCES (2004) - in MCM**
- Annual Replenishable Ground Water Resources : 794.35
- Gross Annual Ground Water Draft : 419.55
- Projected Demand for Domestic & Industrial Uses upto 2029 : 30.26
- Stage of Ground Water Development : 57.44%
- 13. AWARENESS AND TRAINING ACTIVITY**
- Mass Awareness Programmes Organized : None
- Date : -
- Place : -
- Number of Participants : -
- Water Management Training Programme Organized : None
- Date : -
- Place : -
- Number of participants : -

**14. EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING**

Projects completed by CGWB (No & Amount spent) : None

Projects under technical guidance of CGWB (Numbers) : None

**15. GROUND WATER CONTROL AND REGULATION**

Number OF OE Blocks : Nil

Number of Critical Blocks : Nil

Number of blocks notified : Nil

**16. MAJOR GROUND WATER PROBLEMS AND ISSUES** : Water logging and Sodic land development is basically associated with canal seepage / irrigation in few pockets. Deeper aquifers at places are yielding brackish ground water.

# **DISTRICT GROUND WATER BROCHURE OF AURAIYA DISTRICT, U.P.**

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## **1.0 INTRODUCTION**

### **1.1 Administrative Details:**

The district of Auraiya which is named after its headquarter town, has two Tehsils i.e. Auraiya and Bidhuna. The district occupies geographical area of 2015 sq. kms. in Ganga-Yamuna Doab. For the convenience of developmental activities, the district is divided in to seven developmental blocks. The Auraiya tehsil contains three blocks i.e. Auraiya, Bhagya Nagar and Ajitmal, whereas the Bidhuna tehsil includes four blocks i.e. Bidhuna, Airwakatra, Sahar and Achalda blocks. As per 2001 census the district enjoys a total population of 1179993 with population density of 586 persons / km. The literacy rate in the area is 70.5.

### **1.2 Basin / Sub-basin:**

The Auraiya district falls in Ganga basin and forms a part of Ganga - Yamuna Doab, covering the parts of Rind and Sengar river water sheds. A minor stretch along its southern border is however forms the part of Chambal water shed.

### **1.3 Drainage:**

The area is drained by the tributaries of river Yamuna viz., Sengar, and Rind which generally flow from NW to SE direction. River Yamuna and its major tributary Chambal drain through southern most bordering parts of the district and flow in SE direction. The rivers and tributaries are perennial and follow a meandering course in narrow flood plains.

### **1.4 Land Use:**

District statistical data (2006-07) reveal that Auraiya district has utilized 1438.42 sq. km. area for cultivation. The district still has 2.72% land suitable for

cultivation. Only 102.83 sq. km area is put under forest cover which much below the state average and environmental standard.

### **1.5 Irrigation:**

Both surface and ground water being used for irrigation in the area. Approximately 82% (1193.55 sq. km.) land of the total area is covered by various irrigation methods, out of which 54.36% area is shared by ground water and remaining by surface water.

The Etawah Branch of Lower Ganga Canal System passes through the area. A substantial length (826 km) of canal network contributes to irrigate the area.

### **1.6 Studies 1 Activities of C.G.W.B.:**

The systematic ground water survey of the area under Auraiya district (erstwhile Etawah district from which Auraiya district is separated) has been undertaken by Geological Survey of India during 1968-69 & 1969-70. The first reappraisal survey in this area was carried out by C.G.W.B. during 1988-89. The study has been focused mainly on hydrogeological condition of the area including water bearing formation, aquifer geometry and hydrological properties of the aquifer material, resource estimation and quality assessment of ground water. Subsequently, the area was surveyed during 1994-95 and 2002-03 field seasons focusing mainly on the above sited objectives for diurnal assessment of the ground water scenario of the district. Ground water exploration was also carried out by CGWB to decipher the aquifer disposition and hydrological properties of water bearing formations.

## **2.0 RAINFALL & CLIMATE**

### **2.1 Rainfall:**

The normal rainfall in Auraiya district is 807.35 mm (1901-1970 records) of which 88% is contributed from monsoon season (June to September) and remaining 12% rainfall occur during Non-monsoon period.

## **2.2 Climate:**

The climate of the district is sub-humid and characterized by hot summer and bracing cold season. After February there is continuous increase in temperature till May which is generally the hottest month. The mean daily maximum temperature in May is 41.8°C and the mean daily minimum is 7.4°C in the month of January.

During the southwest monsoon season the relative humidity is high and after the withdrawal of the monsoon humidity decreases. The mean monthly morning relative humidity is 60%, and means monthly evening relative humidity is 41 %.

Winds are generally very light. During the period May to September winds often blow between northeast & southeast directions. The mean of wind velocity is 4.5 km /h. The potential evapotranspiration is 121.5 mm.

## **3.0 GEOMORPHOLOGY & SOIL TYPES**

### **3.1 Geomorphology:**

The district forms a part of the Central Ganga Alluvial Plain which can be divided in to Upland areas (Banda Alluvium & Varanasi Alluvium) and Low land areas (Older flood plain & Younger flood plain). Generally the area forms an extensively level tract which is intercepted at places by sand ridges particularly in northern parts of the district whereas in the southern parts ravine land developed extensively in the vicinity of river Yamuna and Chambal. The terrain has gentle slope from north-west to south-east with a gradient of 0.2 m/km.

### **3.1 Soil Types:**

Broadly four types of soils found in the area are those generally occur in Ganga alluvial plain. These are briefly described as follows;

**Bhur:** Youngest soil occurs along river beds and contain large portion of sand.

**Matiyar:** Occur in low lying areas and contain large portion of clay.

**Dumat:** It is a loamy soil with dark colour, having clay and sand in equal proportion and can be categorized as intermediate type of bhur and matiyar. Such soil generally occurs in the upland areas.

**Pilia:** A lighter soil than Dumat and is an intermediate type of Dumat and Bhur.

Land Affected by Alkalinity (Sodic Soil): The shallow water level conditions along the lower Ganga canal system at places led to formation of usar (Reh) as is evident in Achalda, Airwakra, Sahar, Bidhuna & Bhagya Nagar Blocks.

## 4.0 GROUND WATER SCENARIO

### 4.1 Hydrogeology:

#### *Water Bearing Formation:*

Exploratory data of C.G.W.B. in Auraiya district inferred that the thickness of the alluvium in the area is around 300m (Drilled depth). Aquifer disposition model of U.P. which also incorporates the deep borehole data of O.N.G.C. and O.I.L. reveals that, in the area, approximately 250 to 300m thick Quaternary alluvium is deposited directly over Vindhyan formation of Pre-Cambrian age.

There is a wide variation in sediments assemblages which is in variant with different depositional environment from north to southern parts of the district. A thick multi-layered aquifer zones occurs within the depth range from 30 mbgl to 300 mbgl (Drilled depth of borehole) which are regionally extended. A thick sequence of gravel bed admixed with ferruginous material and clay encountered at 190 mbgl at Laharpur exploratory borehole in Bidhuna area and 180 mbgl at Dhaurara Slim Hole near Auraiya of C.G.W.B. is a southern derivative. This inferred that the sediments derived from southern provenance are widely spread northwardly below the sediments brought from Himalayan provenance.



### ***Occurrence of Ground Water:***

As mentioned earlier, the entire area is underlain by Quaternary alluvium comprising mainly clay, Kankar, sand & gravel over the basement of Pre-Cambrian Vindhyan formation. Different grades of sand & gravel form the multi-aquifer system in the area, ground water occur under water table condition in phreatic zones & under semi-confined condition in deeper zones.

### ***Depth to water level:***

To monitor the nature of water level and its behavior, ground water monitoring well established in the district are being monitored four times in a year. Pre-monsoon and post-monsoon water level data are collected during May and November months respectively. Depth to water level maps for pre-monsoon and post monsoon periods (Plate-4 & 6) have revealed that the entire area can be divided into different zones on the basis of depth to water level ranges. Fairly a large area has shallow to moderate depth to water conditions. Depth to water level generally varies between 2.0 & 12.0 mbgl. In canal command area, falling under Achalda, Airwakatra, Sahar, Bidhuna & Bhagya Nagar blocks, the depth to water level rests between 2.0 & 4.0 mbgl during pre-monsoon period. The shallow depth to water level is caused, perhaps, due to unregulated canal irrigation by local farmers and or seepage from the various distributories of lower Ganga canal system.

The area where depth to water level rests between 2.0 & 4.0 mbgl during pre-monsoon expands further during post-monsoon period covering some more parts in Sarai Ajitmal block and categorized as area prone to water logging. Few patches along major canals even experience water logged conditions where depth to water level raised to near ground surface or with in 2 mbgl. Deep ground water levels (>8.0mbgl) have also been observed in Sarai Ajitmal and Auraiya blocks in the vicinity of river Yamuna and Chambal.

### ***Seasonal Water level fluctuation:***

The seasonal water level fluctuation has been computed from the water level data obtained from the GWM wells monitored in the area during pre-monsoon & post-monsoon period. Fluctuation in water level is out come of mainly the amount of rainfall received by the area & ground water draft taken from the ground water reservoir. Besides many other factors viz. base flow of rivers, evaporation losses,

seepage from canal etc. also control the inflow and outflow of ground water. In the year 2007 the ground water level fluctuation with respect to Pre-monsoon water levels ranges from 0.06 m at Bandhmau well in Bidhuna block to as high as 2.52 m at Hasulia well in Ajitmal block. There are some locations where unusual negative fluctuation in the range from (-) 0.95 m at Kudarkote in Airwakatra block to (-) 0.07m at Dinamau in Sahar block has been recorded indicating further lowering of water levels during post monsoon period. From these observations it is inferred that such areas have moderate to low recharge over the ground water draft during the period.

***Long Term Water Level Trend:***

Water level trends available for 11 National Hydrograph stations of the area reveals that there is significant declining trend of pre-monsoon water level (to the tune of 0.0024 m to 0.5252 m/year) at 9 stations, while the other 2 stations of the district shows rising trend of pre-monsoon water level of the order of 0.0087 m/year to 0.0177 m/year, which may be a local effect of canal irrigation/ seepage.

***Hydrogeological Characteristics of Aquifer:***

The hydrological records of a number of wells constructed in the district for irrigation and drinking water purposes indicates that the yield of the wells varies between 12.90 lps to 62.15 lps. Drawdown ranges from 2.60 m to 18.75 m & the specific capacity from 0.69 to 14.90 lps/m of drawdown. The static water level in these tube wells rests between 9.78 to 16.00 mbgl.

**4.2 Ground Water Resources:**

Block-wise ground water resources as estimated using GEC, 1997 methodology jointly by CGWB and State Ground Water Department on 31.3.04 are tabulated as follows:

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.	Achalda	14416.49	12974.84	7147.11	5697.84	55.08	Safe
2.	Airwa Katra	10818.74	9736.86	5864.48	3775.13	60.23	Safe
3.	Ajeetmal	7550.29	7172.77	3763.76	3312.81	52.47	Safe
4.	Auraiya	12177.59	11568.71	3798.95	7697.21	32.84	Safe
5.	Bhagya Nagar	11013.99	9912.59	6202.83	3608.64	62.58	Safe
6.	Bidhuna	11222.94	10661.79	9134.31	1423.29	85.67	Semi-critical
7.	Sahar	12234.69	11011.22	6043.99	4853.16	54.89	Safe
	<b>Total</b>	<b>79434.73</b>	<b>73038.79</b>	<b>41955.43</b>	<b>30368.09</b>	<b>57.44</b>	

#### 4.3 Ground Water Quality:

Ground water in phreatic aquifer, in general, is colourless, odorless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone was in the range of 405-1045  $\mu\text{s}/\text{cm}$  at 25°C. About 50% of samples analysed show electrical conductance less than 750  $\mu\text{s}/\text{cm}$  at 25°C.

It is observed that the ground water is suitable for drinking and domestic purposes in respect of all the constituents except nitrate. Nitrate contents are found in excess of 45 mg/l in 17% of samples analysed, this may be due to the use of fertilizers for agriculture and other improper waste disposal.

#### 4.4 Status of Ground Water Development (Block-wise):

The ground water development in the district is basically through Tube wells (shallow & deep) and hand pumps. Dug wells are also in use occasionally for drinking water purposes. Only Bidhuna block is categorized as semi-critical with 88.67% ground water development. All the other six blocks are put in safe category with stage of ground water development range between 32.84-62.58% (as on 31.3.04).

The net annual ground water availability in the district is 730.38 MCM and the gross ground water draft for all uses in the district is of the order of 419.55 MCM, leaving 303.68 MCM of ground water available for future developments.

## **5.0 GROUND WATER MANAGEMENT STRATEGY**

### **5.1 Ground Water Development:**

The area is considered to be economically backward, and its major population (88%) is engaged primarily in agricultural activity with little land holdings and negligible forest cover. Almost 71% land of the district is put under active cultivation. Two principal harvest of the district are Rabi & Kharif. Irrigation depends upon surface as well as on ground water resources. Out of the total irrigated land (1193.55sq. km.), about 54.36% is covered by ground water resources.

### **5.2 Water Conservation & Artificial Recharge:**

As the district receives 807.35 mm of annual rainfall there is ample scope of rainwater harvesting in existing ponds by rejuvenating these and even constructing new pond in the low lying areas with enough catchment's. Construction of Percolation tanks and recharge shafts may be an economical option in areas with deeper water levels on community basis. Check dams (earthen) can also be constructed across the natural drainage through government support. There is a considerable scope of roof top rainwater harvesting in the habitations for domestic requirements.

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

### **6.1 Water Logging:**

A considerable part of the district fall under water logging and prone to water logging conditions as depth to water level rest within 4 mbgl during pre and post monsoon period. Such areas generally fall in the vicinity of major canals and distributories, indicating excessive seepage from these canals.

### **6.2 Depleting Ground Water Level:**

Seasonal and long term water level records indicate a very moderate and gradual declining of water levels to the tune of 0.0024m to 0.5252 m/year.

### **6.3 Usar Land:**

The occurrence of thick clay and kankar bed at shallow depth develops 'reh' in some areas making the land non-agriculturable due to salt encrustations.

## **7.0 AWARENESS & TRAINING ACTIVITY**

### **7.1 Mass Awareness Programme (MAP) & Water Management Training Programme (WMTP) by CGWB:**

Mass Awareness Programme and Water Management Training Programme has not been conducted yet in the district.

### **7.2 Participation in Exhibition, Mela, Fair etc.:**

No participation by CGWB in any of the exhibition, Mela, Fair etc

### **7.3 Presentation & Lectures Delivered in Public Forum / Radio / T.V. / Institution of Repute / Grass root Associations / NGO / Academic Institutions etc.:**

Not any presentation & lectures delivered in public forum / radio / T.V. / institution of repute / grass root associations / NGO / academic institutions etc.

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

None of the areas has been notified in the district by either of the organisations.

## **9.0 RECOMMENDATIONS**

Rain water harvesting and augmentation of ground water by artificial recharge should be encouraged in areas where ground water levels have gone substantially down. Direct recharge techniques may be applied in such areas where shallow aquifers are capped by thick clays strictly under the guidance of specialist.

Conjunctive use of ground water and surface water resources may be viable option in water logged and deep ground water level zones.

Non-agricultural areas where land is affected by 'reh' development due to salt encrustation can be developed by applying Zypsum treatment to the surface soil and by increasing the use of ground water so as to down the ground water levels from phreatic aquifers.

Fig-1

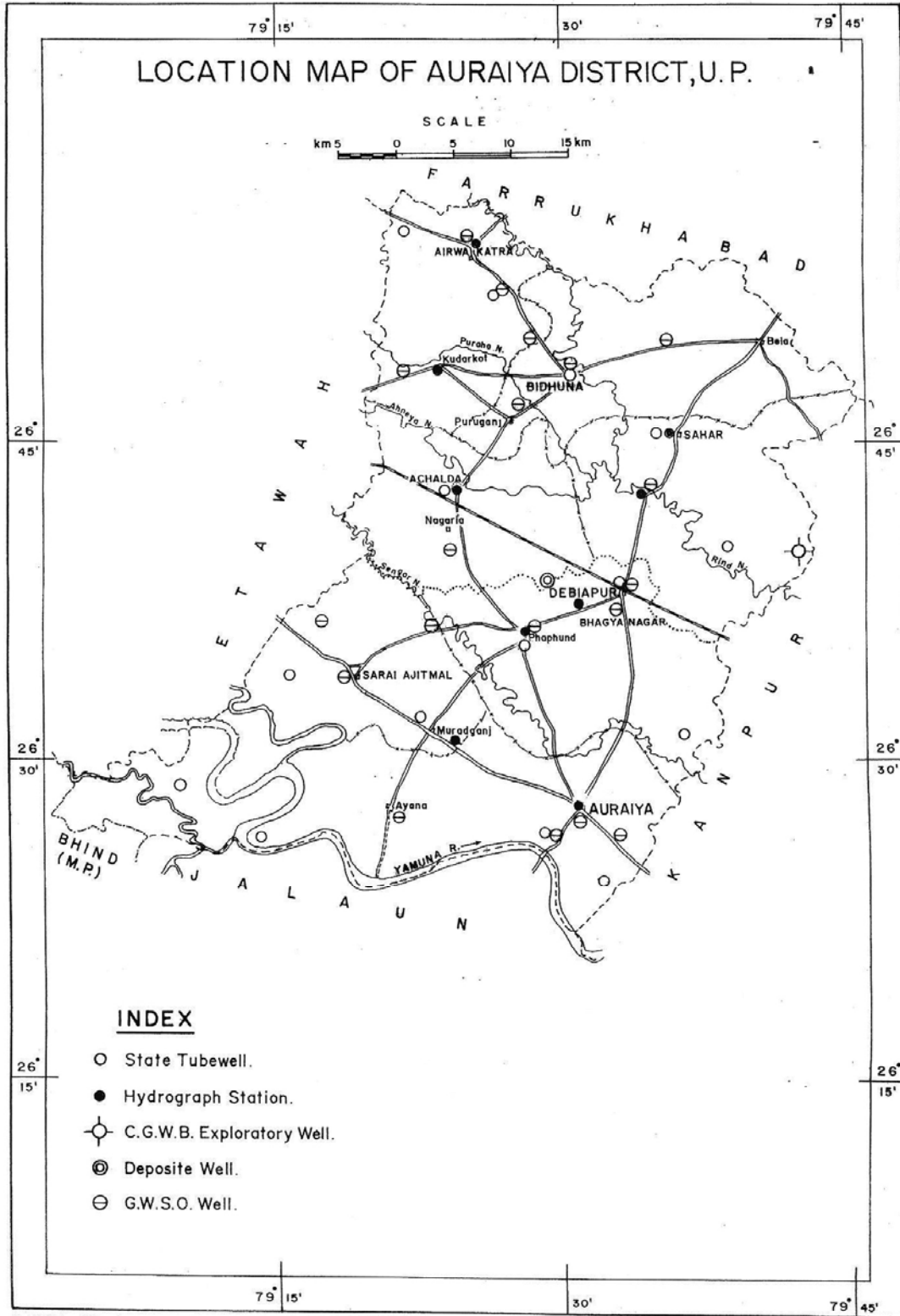


Fig-2

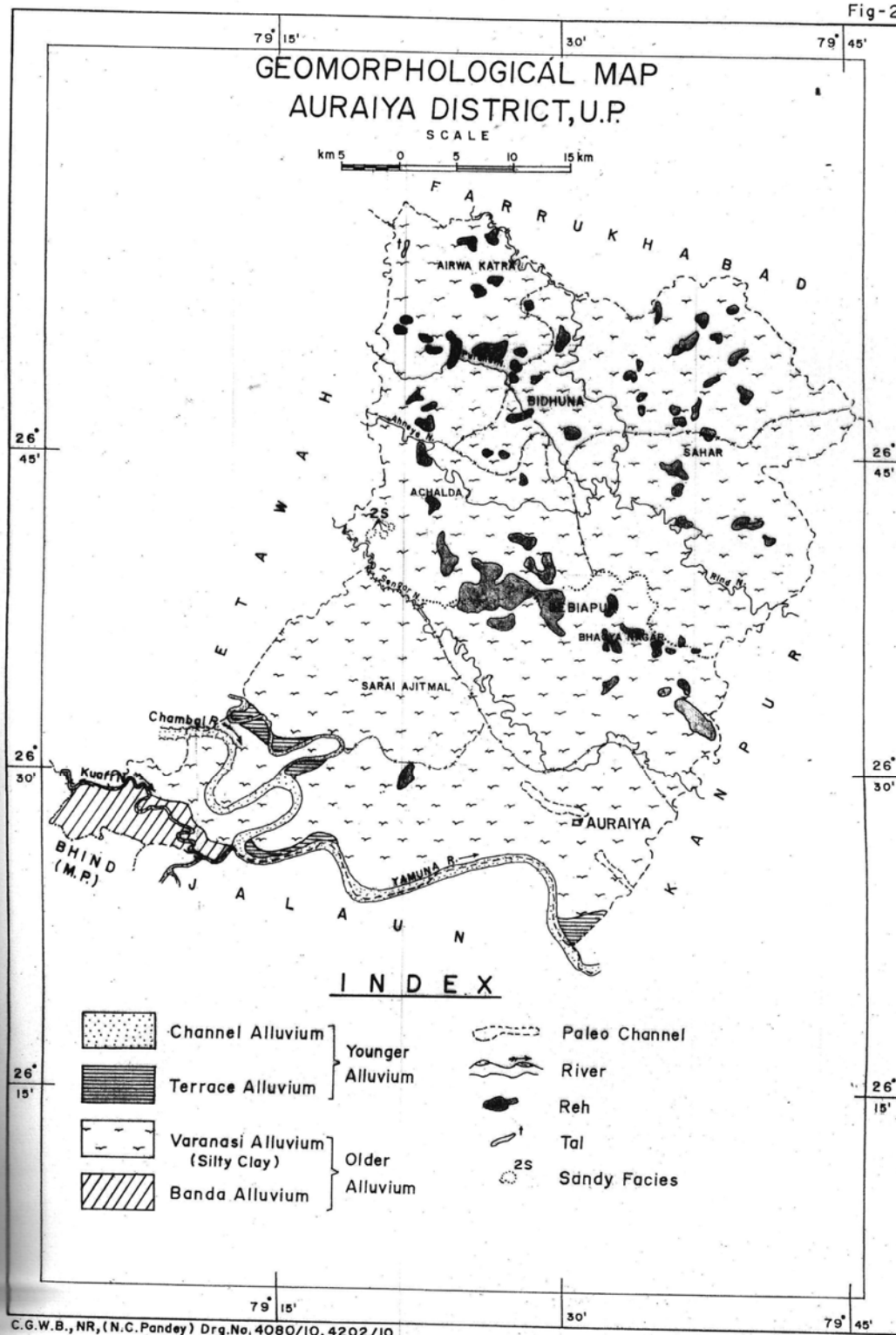




Fig-3

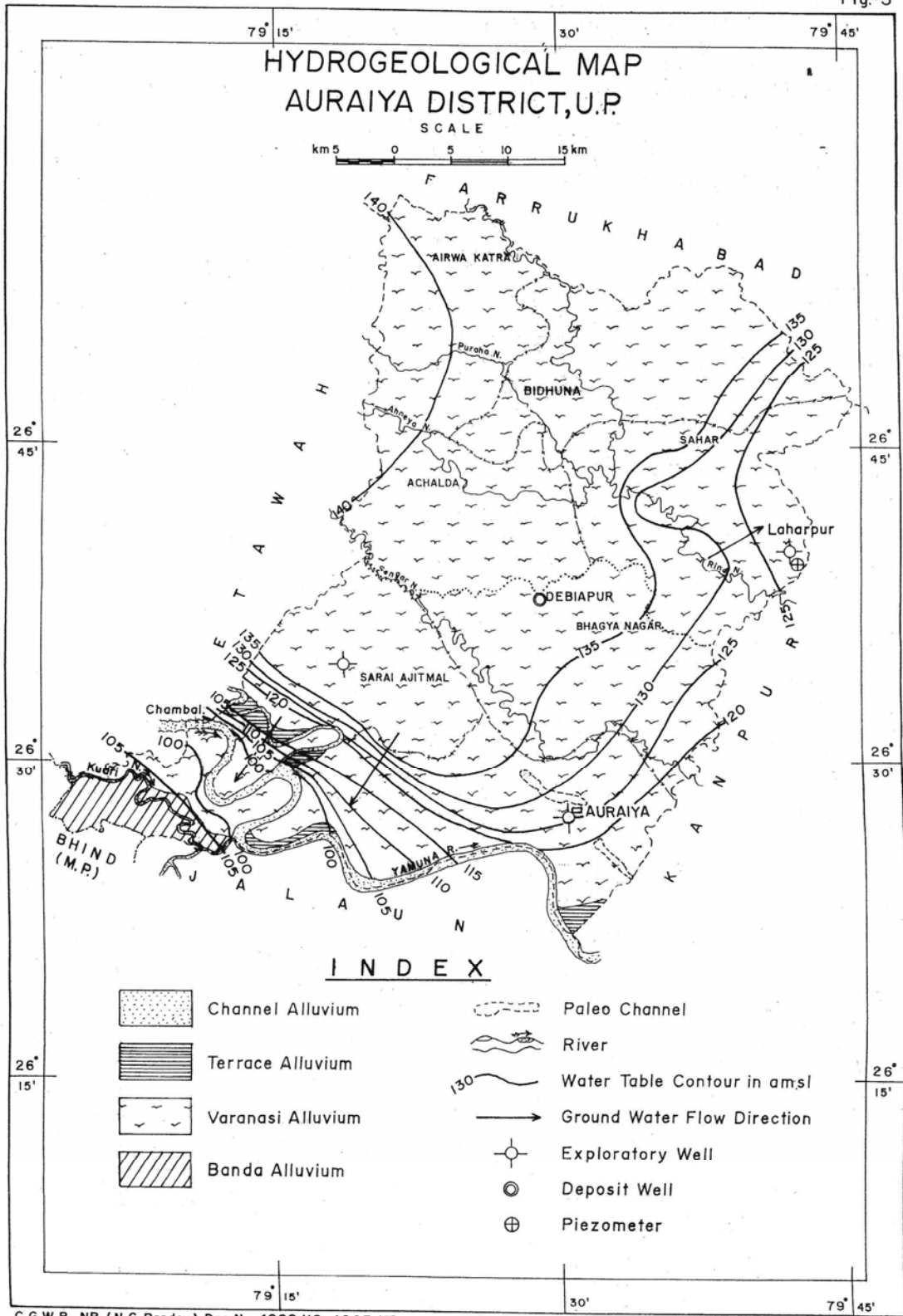
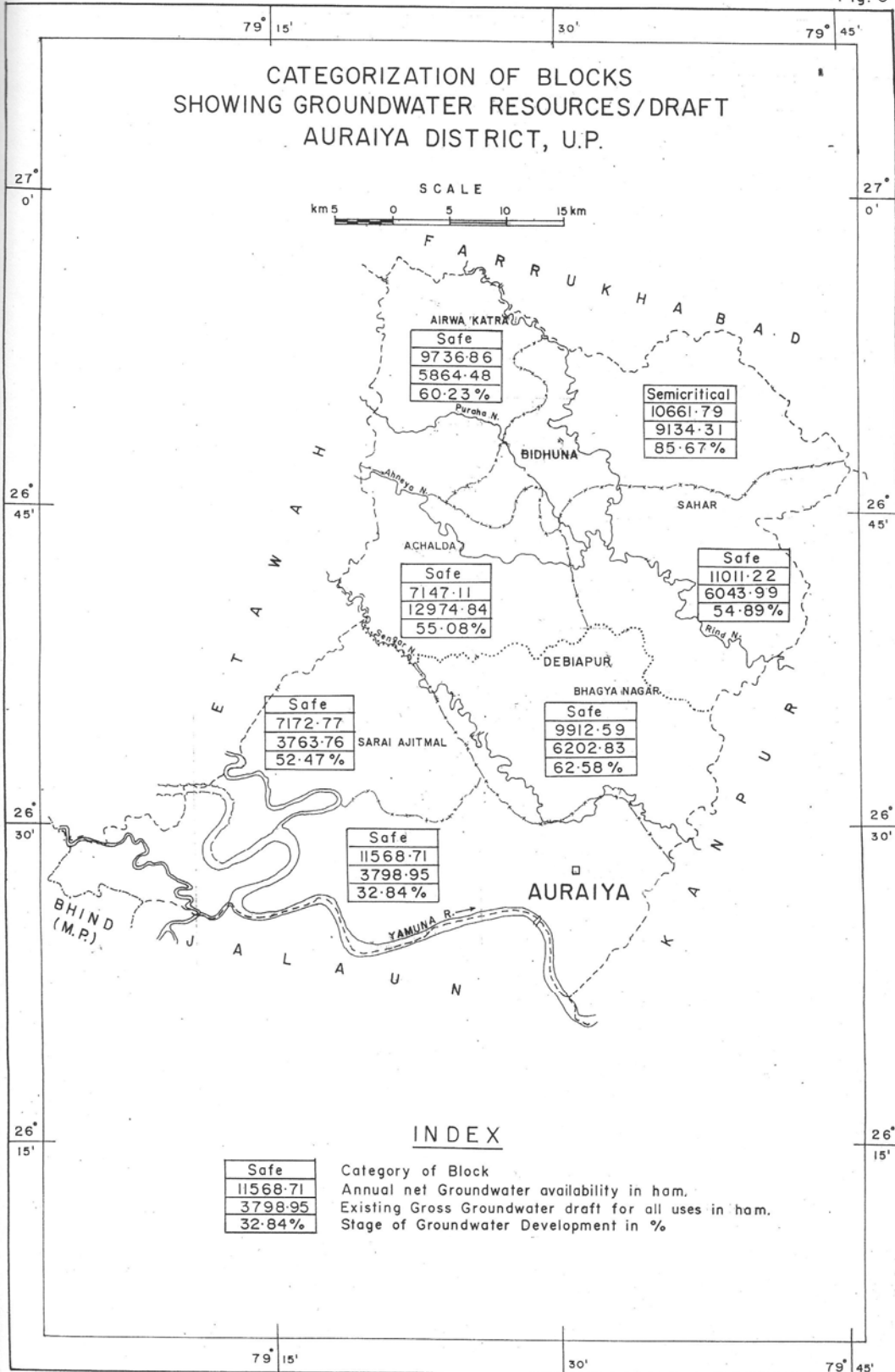






Fig. 6



CGWB, NR, Drg. No. 4076 / 10 (N. Chandra) Drg. No. 4206 / 10