# GROUND WATER BROCHURE OF JHANSI DISTRICT, UTTAR PRADESH (A.A.P.: 2007-2008)

By

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(V) CATEGORIZATION OF BLOCKS (SHOW - GROUND WATER RESOURCES/DRAFTS ETC.).

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GROUND WATER BROCHURE OF JHANSI DISTRICT,
UTTAR PRADESH
(A.A.P.: 2007-2008)

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DISTRIBUTION AT A GLANCE

1. GENERAL INFORMATION
   i. Geographical Area (Sq. Km.) : 5024
   ii. Administrative Divisions (as on 31.3.2008) :
       Number of Tehsil/Block : 4/8
       Number of Panchayat Villages : 437
   iii. Population (as on 2001 census) : 1744907
   iv. Average Annual Rainfall (mm) : 850.1

2. GEOMORPHOLOGY
   Major Physiographic Units : Southern Bundelkhand Pediplanes Province and Northern Highly Eroding composite Plain Province
   Major Drainages : Betwa, Dhasan and Pahuj

3. LAND USE (Sq. Km.)
   a) Forest area : 373.78
   b) Net area sown : 3267.97
   c) Cultivable area : 4186.53

4. MAJOR SOIL TYPES : ---

5. AREA UNDER PRINCIPAL CROPS (as on 2005-06) : 418653 ha

6. IRRIGATION BY DIFFERENT SOURCES
   (Areas and Number of Structures) (ha)
   Dugwells : 93501/636
   Tubewells/Borewells : 12484/12138
   Canals : 75235/1236 Km.
Other Sources : 3516/181 ha
Net Irrigated Area : 196078
Gross Irrigated Area : 200491

7. NUMBERS OF GROUND WATER MONITORING
   WELLS OF CGWB (As on 31-3-2007)
   No. of Dugwells : 16
   No. of Piezometers : Nil

8. PREDOMINANT GEOLOGICAL FORMATIONS

9. HYDROGEOLOGY
   Major water bearing formation : Fractured and weathered granite

   (Pre-monsoon Depth to water level during 2007) : 2.95-15.12 mbgl
   (Post-monsoon Depth to water level during 2007) : 2.47-16.07 mbgl
   Long term water level trend in 10 years (1998-2007) in m/yr : Rise 0.038 to 0.4280 m/yr
                                                             Fall 0.0733 to 1.0585 m/year

10. GROUND WATER EXPLORATION BY CGWB (As on 31-3-2007)
    No. of wells drilled (EW, OW, PZ, SH, Total) : EW-42, OW-06
    Depth range (m) : 160-750
    Discharge (litres per second) : 16-25 (Marginal Alluvial Plain Areas)
                                 : 3-10 (Hard Rock Areas)
    Storativity (S) : ---
    Transmissivity (m²/day) : 50-200

11. GROUND WATER QUALITY
    Presence of Chemical constituents more than permissible : Nil
    limit (e.g. EC, F, As, Fe)
    Type of water : Good

12. DYNAMIC GROUND WATER RESOURCES (2004)-in MCM
    Annual Replenishable Ground Water Resources : 70914.15 ham
    Gross Annual Ground Water Draft : 28616.90 ham
13. AWARENESS AND TRAINING ACTIVITY
Mass Awareness Programmes organized: one
Date: 7.3.2002
Place: Jhansi, Block Baragaon
No. of participants: 200
Water Management Training Programme organized: NIL
Date
Place
No. of participants

14. EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING: NIL
Projects completed by CGWB (No & Amount spent)
Projects under technical guidance of CGWB (Numbers)

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 scarcity and drought prone area

1.0 INTRODUCTION

Jhansi district in the southwestern part of the Uttar Pradesh lies between 25°07’ and 25°57’ north latitude and 78°10’ and 79°25’ east longitudes. Total Geographical areas of the district is 5024 sq. km. District headquarter is at Jhansi and there are four number of Tehsils namely Jhansi, Moth, Gauratha and Mauranipur (Plate-I). There are eight numbers of blocks in the district. As per 2001 census, district's population was 1744907 souls of which 932800 were males and 812107 females. Rural population was 989157 and urban population was 755774. Schedule caste population was 489763 and schedule tribe population 1070.
The area is comprised of Bundelkhand gneissic complex of archean age and alluvium of recent age. Physiographically, the area can be divided into two units i.e. Southern Bundelkhand Pediplane Province and Northern Highly Eroding Composite Plain Province.

Main source of irrigation in the district is through ground water and canal. Total length of canal is 1236 km by which 75235 hectare area is irrigated. There are 89 no. of government tubewells through which 3806 hectare area is irrigated. Irrigation by private tubewell is 8678 hectare. Hence 54% area is irrigated by ground water. Net sown area is 326767 hectare and net irrigated area is 196078 ha. The ratio of net irrigated area to net sown area is 60%. For drinking water supply pipe line schemes and India Mark II hand pump exist in the district. There are 739 India Mark II hand pumps for providing water to 863342 persons.

The area is chiefly drained by the river Betwa and minor river like Dhasan and Pahuj. The Betwa and Pahuj rivers are tributaries of Yamuna and Dhasan is tributary of Betwa. The major tributaries of Dhasan are the Lakheri, Sukhnai, Kurera etc which are mainly ephemeral. All three main rivers are perennial.

Previously, geo-hydrogeological investigation was carried out by Shri D.L. Sah, Geological Survey of India, during 1961-62 in the district. The CGWB carried out special hydrogeological investigation for augmenting water supply in drought affected areas of the district during the field season programme 1980-81. The studies carried out by S/Sh H.R. Mankhand, S.Z. Hadi and S.P. Khanna. Reappraisal hydrogeological survey in the district Jhansi was carried out by S/Shri A.V. Singh and A.K. Bhargava during the F.S.P. 1987-88. Again reappraisal hydrogeological survey was carried out by Shri A.V. Singh during A.A.P. 2001-02. After that ground water exploration in Jhansi district was carried out during 2001-2006 to know the yield prospects of fracture zone/lineaments in Bundelkhand granite complex.

2.0 CLIMATE AND RAINFALL

The average annual rainfall is 850.1mm. The climate is sub-humid and it is characterized by a hot dry summer and cold winter. About 91% of rainfall take
place from June to September. During monsoon surplus water is available for charging to ground water.

January is the coldest month of the year when the mean daily maximum temperature is 24.1°C and the mean daily minimum temperature is 9.2°C, May is the hottest month with mean daily maximum temperature is 42.6°C and mean daily minimum temperature is 28.8°C. The mean monthly maximum temperature is 32.6°C and mean minimum temperature is 19.2°C.

In the summer season the air is very dry and during the monsoon season the moisture content of air is high. The mean monthly relative humidity is 41%. During the post monsoon and winter season winds are light and in the summer and monsoon season the winds strengthen slightly. The mean wind velocity is 4.8 Kmph. The potential evapotranspiration is 1603.3 mm.

3.0 GEOMORPHOLOGY

Jhansi district area is gradually sloping in the north-easterly direction. The southern Bundelkhand plateau area in general resumes the height ranging from about 200m above mean sea level towards north to about 345 m. above mean sea level on the south. Viz (a) southern Bundelkhand pediplain province and (b) northern highly eroding composite plain province.

Soil Characteristics:

The soil found in the area may be classified into two group on the basis of colour and topography i.e. red (upland soils) and black (low land soils). On the basis of texture, the red soil is further divided into ‘Rakar’ and ‘Parwa’ and the black soil group into ‘Kabar’ and ‘Mar’.
4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

The northern part of the district is occupied by the alluvium of quaternary age (Plate-II). The alluvium consisting of mainly fine to coarse sand, gravel, pebble, silt, clay and kankar attains a maximum thickness of about 60.00 meters. The alluvium together with the underlying weathered zone of granite-gneissic basement form a more or less homogeneous aquifer system. The northern aquifer system yields moderate quantities of ground water through dugwells and tubewells.

In southern parts of the district, the weathered zone of Bundelkhand granite-gneissic complex of Archean age and overlying residual soils largely forms the aquifer system. The aquifer system exhibits heterogeneity to some extent due to impervious nature of frequently occurring outcrops, hillocks and linear quartz reefs. This aquifer has an average thickness of about 20 to 40 meters and yield is limited to moderate through dugwells and tubewells.

Ground water occurs under water table conditions in plains. In the granitic terrain ground water occurs in fractures and in fine interstices of the weathered rock material.

a) Depth to Water Level:

As per depth to water level data of ground water monitoring stations of year 2007, pre monsoon water level varies from 2.95 to 15.12 mbgl (Plate-III). In general during pre monsoon the depth to water level varies from 5 to 15 mbgl. Shallow water levels are observed only as patches around Moth & Gursarai. Western part of the district normally shows water levels between 5 & 10 mbgl. In post monsoon period (Plate-IV) depth to water level varies from 2.47 to 16.07 mbgl. Water level fluctuation varies from 0.85 to 3.65 meters. Shallow water level is observed in canal network area. The deepest water level of about 19.00 mgl is observed at Eraich in northeastern part of the district.

Long Term Water Level Trend:

The long term water level trend for ten years (1998-2007) of 18 ground water monitoring wells have shown that only two monitoring stations show rising trend.
These stations are Moth and Jhansi. It varies from 0.0308 to 0.4280 m/year. Remaining wells show annual falling trend varies from 0.0733 to 1.0538 m/year. During pre monsoon period the rising trend is observed at Moth, Semari and Jhansi-1, varies from 0.1332 to 0.7180 m/year and remaining 15 ground water monitoring stations show a falling trend varying from 0.0723 to 0.7822 m/year. Whereas, during post monsoon period rising trend is observed at Moth, Mauranipur, Gursarai and Jhansi-1 from 0.1258 to 0.2906 m/year, remaining 14 ground water monitoring stations show a falling trend from 0.1205 to 1.3373 m/year.

The yield of deep tubewell constructed upto 150 m bgl in hard rock area by CGWB varies from 200 to 600 lpm at normal drawdown. The hydraulic parameters have been computed based on the pumping tests on exploratory tubewells constructed by CGWB. The transmissivity varies from 50 to 200 m²/day.

4.2 GROUND WATER RESOURCES:

As per report on Dynamic Ground Water Resources of Uttar Pradesh as on 31.03.2004 annual ground water availability of the district is 66823.61 ham. The gross ground water draft for all uses is 28616.90 ham. The stage of ground water development is 42.82%. As per the estimates worked out all blocks are in safe category.

4.3 GROUND WATER QUALITY:

Ground water of the district is colourless, odourless and very slightly alkaline in nature. Electrical conductance ranges from 400-500 micromhos/cm. at 25°C. Out of the total samples, 18% of water samples analyzed have high NO₃ (above permissible limit of 45 mg/l). Fluoride is within permissible limit ranging from 0.08-1.0 mg/l. Phosphate is not found in the district. It is observed that ground water quality is suitable for drinking and irrigation purposes.

The As (Arsenic) content has been found within permissible limit (10ppb).

4.4 STATUS OF GROUND WATER DEVELOPMENT:

In all blocks of the district ground water development takes place through dugwells, borewells and state tubewells. The relevant details are given below:
<table>
<thead>
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<th>S. No.</th>
<th>Type of structure</th>
<th>Number</th>
<th>Depth Range (mbgl)</th>
<th>Yield (lpm)</th>
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<td>1.</td>
<td>Dugwells</td>
<td>25987</td>
<td>5.50-25.00</td>
<td>50-200</td>
</tr>
<tr>
<td>2.</td>
<td>State tubewells</td>
<td>89</td>
<td>50.00-100.00</td>
<td>200-600</td>
</tr>
<tr>
<td>3.</td>
<td>Rahat</td>
<td>3982</td>
<td>10-25</td>
<td>100-200</td>
</tr>
</tbody>
</table>

The shallow dugwells are found in canal command area and the deeper ones are located along the Betwa rivers. The wells generally meet the domestic and irrigation requirements. There are 10594 diesel pumpsets fitted in the dugwells for irrigation. Maximum number of diesel pumpsets are in Mauanpur block i.e. 1853 and minimum are in Babina block i.e. 826. Maximum number of electric pumpsets are in Mauanipur block i.e. 166 and minimum are in Babina block i.e. 7. Maximum number of State tubewells for irrigation are in Moth block i.e. 38 and minimum numbers are in Gursarai block i.e. 4. The area irrigated through state tubewells and private tubewells in the district is 3806 & 8678 ha. respectively. In three blocks namely Moth, Chirgaon and Bamaur, the only source of irrigation is ground water since the area is devoid of canal network system. Maximum area irrigated through canal is in Moth block (31623 hectare) and minimum in Babina (1793 hectare).

Drinking water tubewells have been constructed by Central Ground Water Board under exploration programme in town area and villages. Depth of drinking water tubewells varies from 100 to 150 mbgl. The yield of tubewells varies from 200 lpm to 600 lpm in hard rock areas. The total 42 number of tubewells have been constructed in the district so far. Maximum number of hand pumps are in Moth block i.e. 121 and minimum are in Babina block 72. Depth to these hand pumps varies from 30-50 m.

5.0   GROUND WATER MANAGEMENT STRATEGY

5.1   GROUND WATER DEVELOPMENT:

The stage of ground water development in the district is 42.82%. The maximum stage of ground water development is in Babina block (67.44%) and minimum stage of ground water development is in Bamaur block (15.70%). All eight blocks are in safe category. Hence, all blocks have good scope for further ground
water development through tubewells in northern part (marginal alluvium plain) as well as southern part (hard rock area). The tubewells of depth upto 25 meters and tapping 12 to 20 meters of granular zone can be constructed in marginal alluvium plain. In hard rock areas the tubewell may be constructed upto 100 to 150 mbgl after carrying out hydrogeological studies. After casing the weathered zone drilling should be carried out in hard rock using different size button bits in telescopic manner (8½”, 6½” and 6” dia) that will be uncased or naked hole.

5.2 WATER CONSERVATION STRUCTURE & ARTIFICIAL RECHARGE:

In the district, number of tanks, ponds and reservoirs have been constructed in the district taking advantage of the typical physiography by building dams across the major and minor streams for storing water for irrigational and domestic purposes. Some important reservoirs are Pahuj dam Parricha dam, Pahari dam, Kamla Sagar and Budhwar Lake. Most of these reservoirs suffer from seepage losses due to fractured nature of Bundelkhand granite and gneisses over these have been constructed.

As district is classified into two lithological units I (Granite Terrain and Pediplane Province) & units II (Composite Plane Province) on the basis of ground water occurrence. Hence water conservation and artificial recharge scheme may be taken up in the district by way of constructing check dams, nala, bunding, subsurface dyke and percolation tanks to check the declining water level trends.

6.0 GROUND WATER RELATED ISSUE AND PROBLEMS

6.1 DRILLING PROBLEMS:

During exploratory drilling in hard rock areas exploratory tubewell were constructed down to 100-150 meter. In some areas of highly fractured granite, borewell, it is difficult to case the borewell due to highly friable nature of these zones. Thus tubewell could not be constructed in spite of the fracture have being good discharge. Sometimes in borewells having high discharge it is difficult to continue drilling due to heavy backpressure.
6.2 RISK TO NATURE DISASTER:

The district lies in the belt of drought prone regions of Uttar Pradesh. The life of the habitants becomes miserable when the water supply source like dugwells, tanks, ponds etc. dry up due to failure of monsoon.

7.0 MASS AWARENESS PROGRAMME

The mass awareness programme on the theme “Ground Water Problems in Jhansi District U.P. and its Mitigation” was organized at Jhansi on 03.3.2003. Shri Jagannath Singh district magistrate was chief guest on the occasion. The programme was organized to aware the common masses about the ground water problems of the hard rock areas and its solution by way of artificial recharge and conservation of water. The programme was attended by about 200 persons & involved officials, Gram Pradhan – Gram Sewak, farmers, teachers and students. The exhibits/poster depicting adverse effects of Arsenic and Fluoride beyond permissible limits in ground water and various techniques of artificial recharge/rain water harvesting were displayed. The local people showed curiosity to go through the exhibits and put up the quarries, which were explained by the scientists of CGWB, NR.

8.0 AREA NOTIFIED BY CGWA/SGWA

None.

9.0 RECOMMENDATIONS

(a) Construction of large dia dugwells with infiltration galleries across the strike.
(b) Construction of tubewells with the help of imageries and hydrogeological investigation.
(c) Construction of sub surface dams in suitable areas to check the discharge into major and minor rivers.

(d) Proper utilization of nature barriers e.g. quartz reef for development of surface water reservoirs.

(e) Construction of small tanks and reservoirs at suitable sites particularly in run off zones.

(f) Construction of small check dams and bunds in major and minor nalas to check flow and to recharge the ground water.

(g) Planned development of surface water irrigation system e.g. canals and lift canals etc. to facilitate the local farmers in agriculture and also recharge ground water.

(h) Promotion of modern techniques of drip irrigation and sprinkler irrigation for cash and high input crops in the undulating agriculture areas with the basic aim of judicious and scientific utilization of irrigation water.

(i) The conjunctive use of available surface water and ground water resources needs to be intensified in the area.
DEPTH TO WATER LEVEL MAP, JHANSI DISTRICT, U.P.
(PRE-Monsoon May 2007)

INDEX

- 0 - 5 mbgl.
- 5 - 10 mbgl.
- 10 - 15 mbgl.
- > 15 mbgl.
DEPTH TO WATER LEVEL MAP, JHANSI DISTRICT, U.P.
(POST - MONSOON Nov. 2007)

SCALE

INDEX

0 - 5 mbgl

10 - 15 mbgl

5 - 10 mbgl

> 15 mbgl
BLOCKWISE GROUND WATER POTENTIAL
JHANSI DISTRICT, U.P.

INDEX

- 1000 ft
- 2000 ft
- 3000 ft
- 4000 ft
- 5000 ft
- 6000 ft
- 7000 ft
- 8000 ft
- 9000 ft
RECOMMENDED AREA FOR GROUNDWATER DEVELOPMENT
JHANSI DISTRICT, U.P.

NATURE OF AQUIFER MATERIALS

GROUNDWATER CONDITIONS

Fine to coarse grained sand, gravel, and alluvium
Ground water occurs in irregular low permeability, coarse soil and water table conditions, depth to water varies, using groundwater resources.

Aquitard

Artesian conditions:

Water table occurs at moderate depths under water body or each portion of water table, with water 30 metres. Ground water potentialities are moderate to high. Dewatered constructed to 80 metres yield 500 litres per minute.

Dike, lake

Fine to coarse grained sand, gravel, and alluvium

Ground water occurs in favourable topographic conditions, leading to high groundwater densities, excellent potential of water.

Creeks, rivers

Ground water occurs in the interstices of weathered rocks near the surface and below the free water of the rock surface. Thickness of weathered rock varies from less than 1 degree to more than 15 metres. Density of water resources is moderate to high. Yield limited to moderate quantities of water through soil water and shallow laterites.

Legend:

Water table extent (Continuous) m a.m. +1
Water table extent (Discontinuous) m a.m. +1
The general direction of ground water movement
Type wall