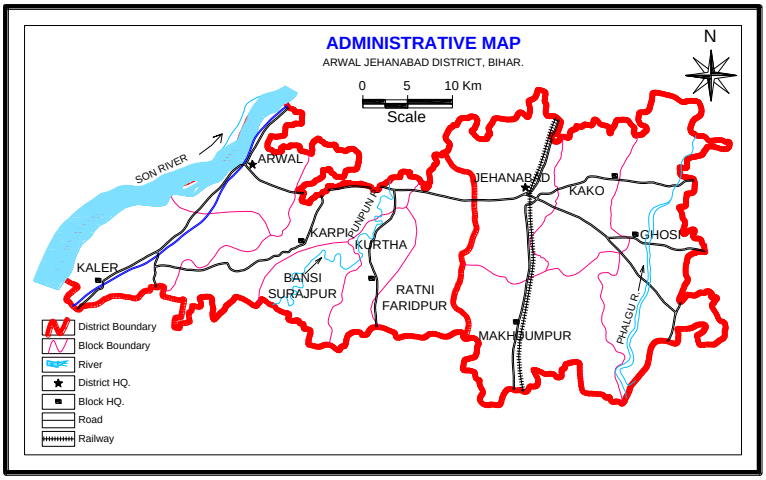
भूजल सूचना पुस्तिका

जहानाबाद जिला, बिहार

Ground Water Information Booklet
Jehanabad District, Bihar State



केन्द्रीय भूमिजल बोर्ड
जल संसाधन मंत्रालय
(भारत सरकार)
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board
Ministry of Water Resources
(Govt. of India)
Mid-Eastern Region
Patna

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1.	**GENERAL INFORMATION**	
	I Geographical Area (Sq. Km.)	933
	II Administrative Divisions **No. of Panchayats/Villages** **Number of Tehsil/Block**	1 93/581 7
	III Population (As per 2011 Census)	Total 1125313 ;Rural: 990117 Urban: 135196
	IV Average Annual Rainfall (mm)	1052
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	Hills, Quaternary Alluvium
	Major Drainages	Phalgu, Dardha, Morhar, Jamuna
3	**LAND USE (Sq. km)**	
	a) Forest Area	6.37
	b) Net Area Sown	737
	c) Total cropped Area	1098.72
4	**MAJOR SOIL TYPES**	Iinceptisols, Entisols.
5	**PRINCIPAL CROPS**	Paddy, Wheat, Maize, Pulses
6	**IRRIGATION BY DIFFERENT SOURCES (Area in hectares)**	
	Dugwells	
	Tubewells/Borewells (STW)	41000
	Tanks/ponds	-
	Canals	13000
	Other Sources	-
	Net Irrigated Area	59000
	Gross Irrigated Area	93000
7	**NUMBER OF GROUND WATER MONITERING WELLS OF CGWB (2011)**	
	No. of Dugwells	05
	No. of Piezometers	Nil
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Quaternary Alluvium
9	**HYDROGEOLOGY**	
	Major water bearing formations	Alluvium
	Pre-monsoon Depth to water level during 2011	4.58 – 9.8 m bgl
	Post-monsoon Depth to water level during 2011	3.52 - 4 m bgl
	Long term water level trend in last 10 yrs(2002 – 2011) in m/yr	No significant decline

10	**GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)**	
	No. of well drilled (EW,OW, PZ, SH, Total)	EW=1, OW=1
	Depth Range (m)	93 - 140 m bgl
	Discharge (m^3/hr)	76.78
	Storativity	-
	Transmissitivity (m^2/day)	120.82
11	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	
	Type of Water	Potable
12	**DYNAMIC GROUND WATER RESOURCES (as on 31st March 2009) in mcm.**	
	Annual Replenishible Ground Water Resources	294.08
	Net Annual Ground Water Draft	188.18
	Projected Demand for Domestic and Industrial Uses up to 2025	28.01
	Stage of Ground Water Development	64%
13	**AWARENESS AND TRAINING ACTIVITY**	
	Two- day Training Programme Organized	1 No.
	Date	20.03.13 &21.03.13
	Place	Jehanabad
	No. of Participants	108
14	**GROUND WATER CONTROL AND REGULATION**	
	No. of OE Blocks	Nil
	No. of Critical Blocks	Nil
	No. of Blocks Notified	Nil
15	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	Not yet reported
	Note: Latest available data may be incorporated	

1.0 INTRODUCTION

1.1 **Administrative Details**

Jehanabad district spreading over an area of 637sq.km (Figure-1) lies south of Patna district with its headquarter at Jehanabad, 50 km away from the state capital, Patna. The district has one sub-divisions - Jehanabad and 7 administrative blocks, namely i) Hulasganj, ii) Kako, iii) Ghosi, iv) Jehanabad, v) Makhdumpur, vi) Ratni Faridpur, vii) Madanganj. The district is bounded in the north by Patna, in the east by Nalanda and west by Arwal districts. The southern part is bounded by Gaya district. The total population of Jehanabad district as per the 2011 census is 1125313 persons with urban population of 135196 persons and the rural population of 990117 persons.

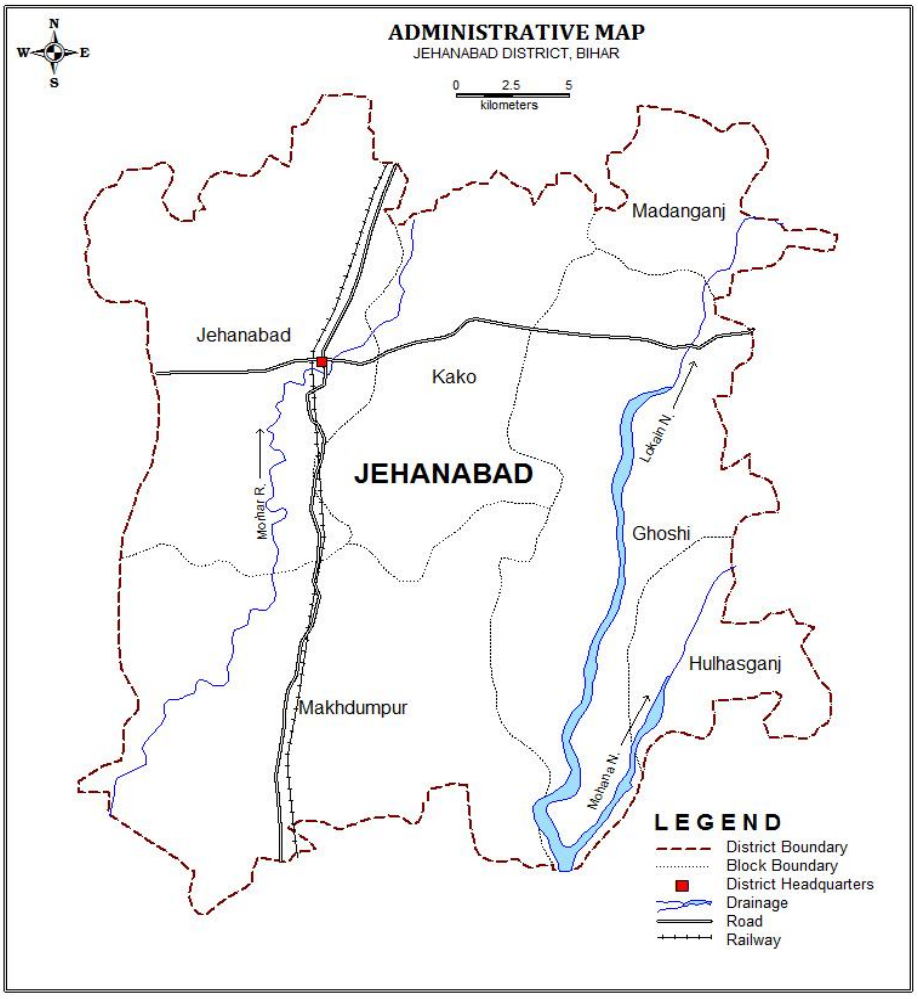

Fig 1. Administrative Map of the Jehanabad district

1.2 Basin/Sub-Basin and Drainage

The district falls under Punpun sub-basin of the Ganga basin. The drainage in the district is mainly represented by the Morhar and Mohana (Falgu) rivers emanating from the southern plateau of Chottanagpur in Jharkhand. Most of the rivers narrow down to small rivulets as they flow from South to North, thereby showing their influent character.

1.3Agriculture and Irrigation Practices

Urban and rural areas mainly depend on Socio-economic and Socio-cultural factors. The salient features of land use pattern in the district (2008-09) are given below:-

Area under forest:	637 hectares
Barren & uncultivable land:	3270 hectares
Land put to non-agril use:	14695 hectares
Permanent pastures:	82 hectares
Other fallow land:	231 hectares
Current fallow:	583 hectares
Net sown area:	73700 hectares
Gross cropped area;	109872 hectares
Area sown more than once:	36172 hectares
Net area irrigated:	59000 hectares
Gross Irrigated area;	93000 hectares

Source: Directorate of Economics & Statistics, Govt. of Bihar

Agricultural activity in the area is by and large confined to the traditional *kharif* cultivation depending primarily on monsoon rainfall and *rabi* cultivation in localized patches where irrigation facilities are available. The major *kharif* crops grown are paddy, maize while among the *rabi* crops wheat, pulses and mustard are important. As per available statistics, out of the gross cropped area of 109872 hectares, 93000 hectares are irrigated by different sources of irrigation e.g. tubewells, dugwells, canals and tanks.

1.4 Studies/Activities carried out by CGWB

Central Ground Water Board has carried out hydrogeological surveys and ground water exploration in the district. Ground water regime monitoring is carried out 4 times annually from 4 HNS wells in the district. Water samples are collected during the month of May to study the changes in water quality along with monitoring of pre-monsoon water level. A two day training programme was organized in the district in the year 2013 involving 108 participants from local bodies, panchayats and NGO's.

2.0 Climate and rainfall

The area experiences a continental monsoon type of climate owing to its great distance from the sea. The climate is extreme and comprises three broad seasons-the summer, the monsoon and the winter. The summer months from the middle of March to May are characterized by hot blasts of westerly winds commonly known as '*loo*'. The peak of summer is in May. The cold spell starts from December and continues till end of February. During this period the mercury drops down to as low as 4^0C.

The monsoon sets in the end of June. The months of July and August are the rainiest months, receiving normal monthly rainfall to the tune of 269.8 and 304.6 mm. The annual normal rainfall of the district (1901-1970) is 1052 mm.

3.0 GEOMORPHOLOGY AND SOIL TYPES

Geomorphologically, the district consists of a flat alluvial terrain; however, it is punctuated with few inselbergs of which the most prominent one is the Barabar hills with maximum elevation of 312 m amsl.

The soils can be broadly divided into two classes-entisol (Younger alluvial soil) & inceptisol (calcareous alluvial soil).

The soil consists chiefly of loam with a small proportion of sand and clay (*kewal).* The soils of this tract are rich in nitrogen and calcium and thus are fertile.

4.0 GROUND WATER SCENARIO

4.1. Water Bearing Formations

The Quaternary alluvium consisting of alluvial sediments, made up of gravels, sands, silt and clays constitute the main water bearing formation. The gravel and medium

to coarse-grained sand layers are good groundwater repositories. The depth of the basement varies from 120 to 150 m below land surface. The alluvial formation overlying the basement holds good aquifers; however, in some parts of this district clays are prominent. The shallow aquifers can be tapped for a discharge of 20m^3/hr, while the deep aquifers can be tapped by wells drilled up to the bed rock yielding about more than 50 m^3/hr. Based on the previous studies by CGWB and the State agencies, the salinet hydrogeological information is presented as under.

Depth ranges of shallow aquifers (in m bgl)	*Jehanabad Bazar: 30-50 (in general)*
Yield potential (discharge) of tube wells tapping shallow aquifer	*15-20 m^3/hr*
Depth ranges of deeper aquifers (in m bgl)	*Jehanabad Bazar: 97-107,113-125,129-140 (in general)*
Yield potential (discharge) of tube wells tapping deeper aquifer (discharge)	*77 m^3/hr at a draw down of 9.0 m*
Transmissivity of deeper aquifers	*121 m^2/day*

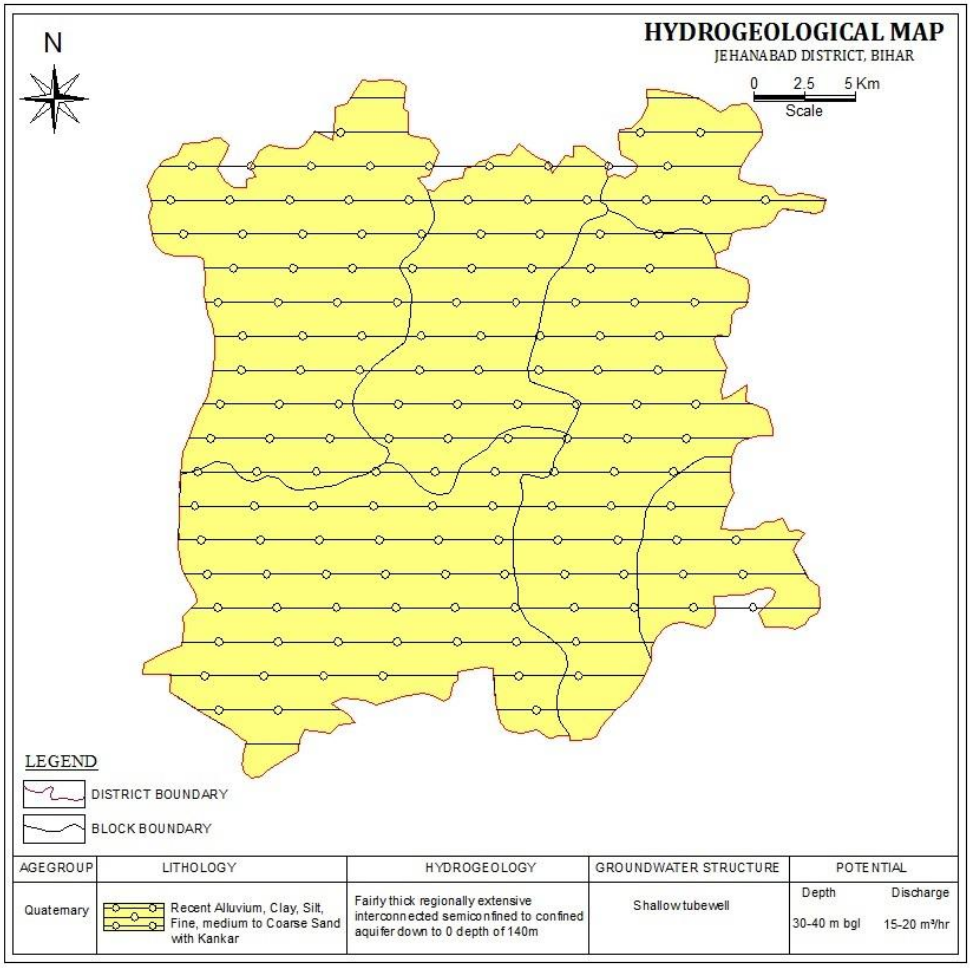

Fig 2. Hydrogeological Map of the Jehanabad district

4.2 Depth to water level

In order to assess the temporal and spatial behaviour of ground water levels over the years four ground water monitoring wells were monitored during pre- and post-monsoon periods in the year 2011.

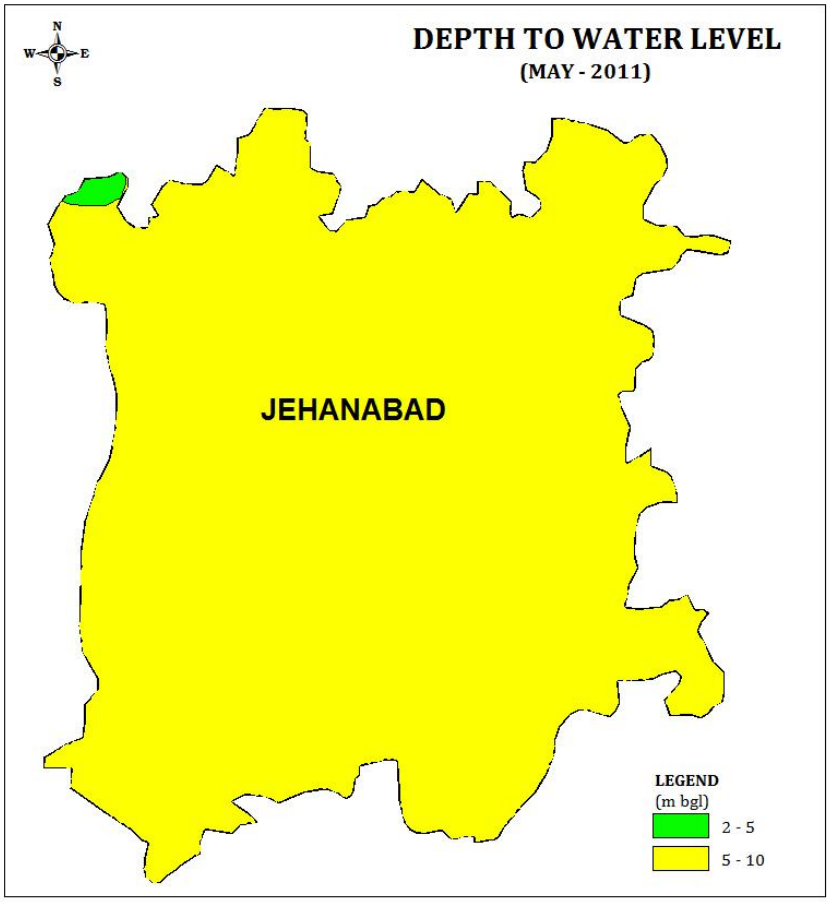

Fig 3. Depth to Water Level (Pre-Monsoon) Map

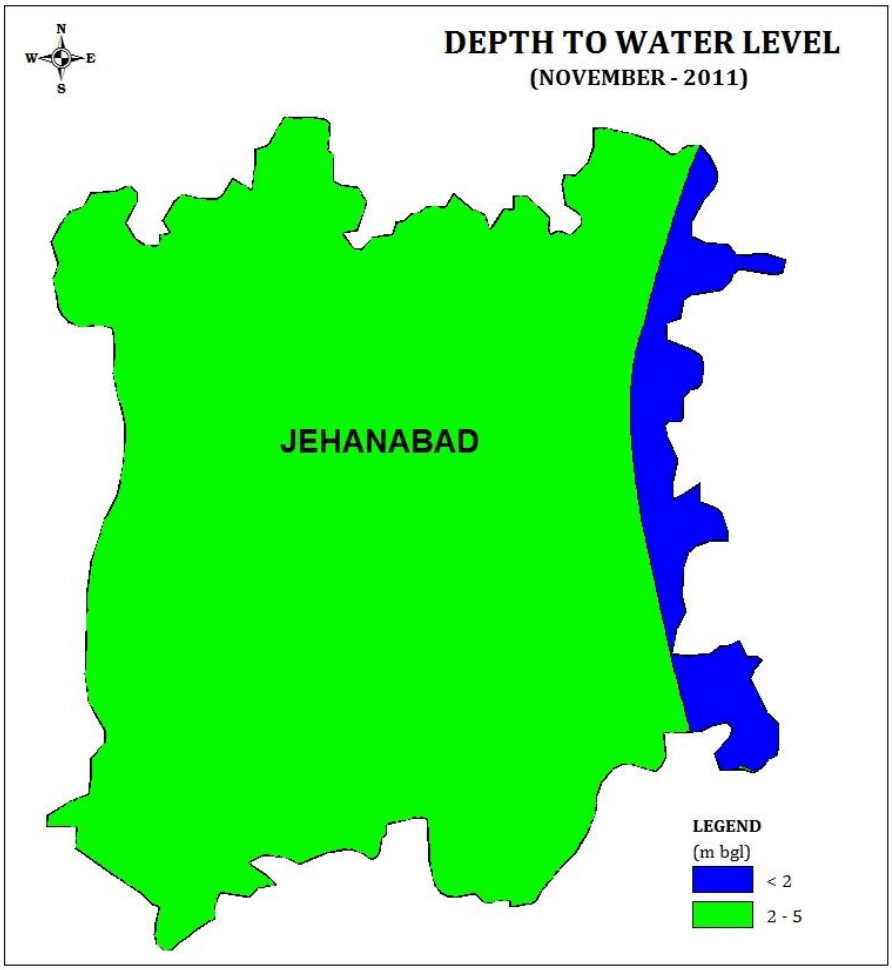

Fig-4. Depth to Water Level (Post-Monsoon) Map

. From the study of the depth to water map (Figure-3), it is evident that ground water level during pre-monsoon period broadly varies between 5-10 m below ground level in the major part of the district. Shallower ground water levels (<5m) were observed over a small patch in the northwestern parts of the district.

From the study of the depth to water map (Figure-4), it is conspicuous that ground water level during post-monsoon period varies mainly between 2-5 m below ground level in the major part of the district. Shallower ground water levels (<2 m) were observed over a linear stretch in the eastern part of the district.

4.3 Ground Water Quality

Ground water in the phreatic aquifers of Jehanabad district is slightly alkaline in nature. The specific conductance of ground water in phreatic zone during pre-monsoon, 2011 was in the range of 664 -3090 µS/cm at 25ºC. The suitability of ground water for drinking purpose has been evaluated on the basis of pH, Total hardness (T.H), Ca, Mg Cl, etc. The chemical concentration of these constituents, when compared with the drinking water specification recommended by IS:10500,1991 indicates that in two samples from HNS at Jehanabad and Junathi exceeded the required permissible limit of Calcium and Magnesium. Higher values of EC (3090 µS/cm) and Chloride (469 mg/l) in the sample collected from Jehanabad HNS may be attributed to improper maintenance of the dug well and its possible contamination from sewage (Table-2).

Table-2. Major Chemical parameters of ground water samples of HNS collected during Pre-Monsoon 2011 in Jehanabad district, Bihar State

SN	District	Location	EC (µS /cm)	pH	CO_3^{2-}	HCO_3^-	Cl^-	Ca^{2+}	Mg^{2+}	TH	Na^+	K^+
					(in mg/lit)							
1	Jehanabad	Jahanabad	3090	7 to 8	ND	622	469	78	64	460	400	18
2	Jehanabad	Jhunathi	1036	7 to 8	ND	494	78	92	49	400	50	14
3	Jehanabad	Kako	664	7 to 8	ND	366	18	38	32	210	56	1.2

4.4 Ground Water Resources

The net annual replenishable ground water resource as on 31st March 2009 works out to be 29408 ha.m. The gross annual draft for all uses works out to be 18818 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 2801 ha.m. The stage of ground water development is 64%. The stage of ground water development is highest in Kako (81.9%) and lowest in Makhdumpur (53.4%). As stages of ground water development in all the blocks are less than 70% except Kako (81.9%), and as there is no long-term decline in water levels, all the blocks are under safe category. The stage of ground water development is depicted in Fig-5. The block-wise ground water resource is given in Table 3.

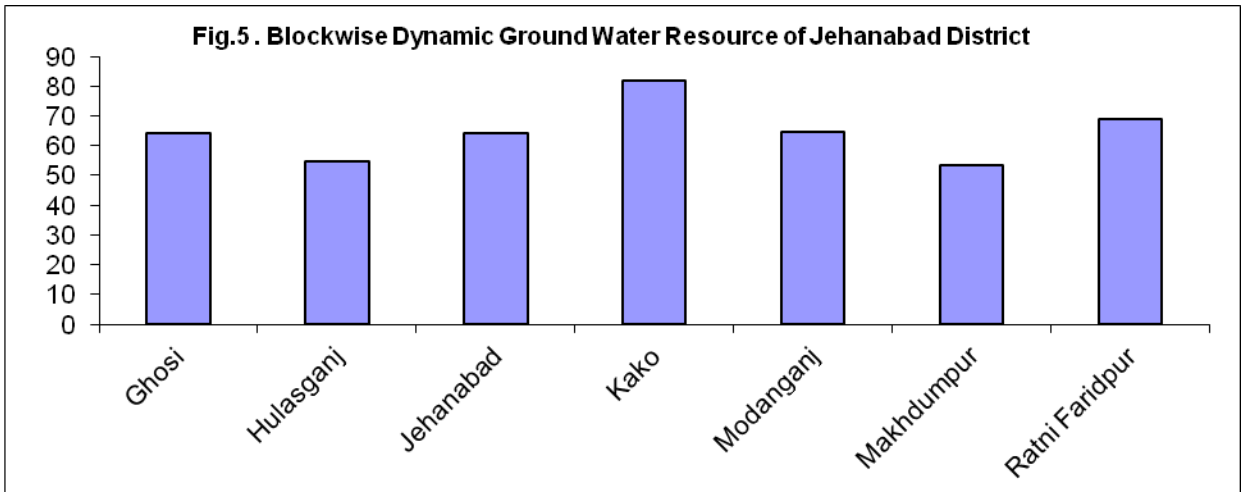

Table 3. Block wise Dynamic Ground Water Resource of Jehanabad District (2008-09)								
							(In hectare meter)	
Sl. No	Assessment Unit/District	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft For all Uses (10+11)	Allocation for Domestic and Industrial Requirement supply upto year 2025	Net Ground Water Availability for future irrigation development (9-10-13)	Stage of Ground Water Development (12/9)*100 (%)
1	**2**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	Ghosi	3444	2063	157	2219	248	1134	64.4
2	Hulasganj	3062	1541	136	1677	215	1306	54.8
3	Jehanabad	4922	2763	393	3156	743	1416	64.1
4	Kako	4495	3430	252	3683	399	666	81.9
5	Modanganj	2437	1455	124	1578	195	787	64.8
6	Makhdumpur	7161	3286	535	3821	659	3216	53.4
7	Ratni Faridpur	3886	2468	216	2684	342	1077	69.1
	Total	**29408**	**17005**	**1812**	**18818**	**2801**	**9602**	64

4.5 Status of ground water development

Stage of ground water development has been calculated based on Gross ground water draft/net availability of ground water expressed as percentage. The categorization of blocks has done based on stage of ground water development and long- term trend of water levels (Pre and Post).

The block wise Stage of ground water development and net GW availability has been presented in Table-3

From the table it has been observed that stage of ground water development ranges from 53.4% (Makhdumpur block) to 81.9 % (Kako block). Out of 7 blocks, 1 block (Kako block) has stage of development more than 70%. As there is no long-term decline in water levels, all the blocks are under safe category.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

Unplanned and indiscriminate development of ground water may lead to either of the following problems i) the depletion of water level ii) water quality deterioration iii) water-logging problem. For aquifers to sustain yield of water at economical rate, in adequate quantity and of suitable quality is an important aspect of ground water management of an area. At present groundwater development in the district is mainly restricted to (a) Domestic, drinking water supply and (b) irrigation uses**.**

Shallow tubewells and dug cum bored wells are being used for raising crops like wheat, mustard etc. The gross ground water draft for the area has been estimated as 18818 ham.

In the district, deep tube wells within 150m depth tapping granular zones between 95-140 m and shallow tube wells within 50m depth, tapping shallow granular zones are the most feasible ground water structures.

5.2 Water Conservation and Artificial Recharge:

In urban areas, rain water available from roof tops of buildings, paved and unpaved areas goes waste. The rain water harvesting system needs to be designed in such a way that it does not occupy large space for collection and recharge system. A few techniques of roof top rain water harvesting that can be followed in urban areas are under:

(i) Roof Top Rain Water Harvesting Through Recharge Pit.

(ii) Roof Top Rain Water Harvesting Through Existing Tubewells/Dug Wells

(iii) Roof Top Rain Water Harvesting Through Trench with Recharge Well

- In areas where the surface soil is impervious and large quantities of roof water or surface runoff is available within a very short period of heavy rainfall, trench/pits are

constructed to store the water in a filter media and subsequently recharge to groundwater through specially constructed recharge wells.

- This technique is ideally suited for area where permeable horizon is within 3 m below ground level.
- Recharge well of 100-300 mm diameter is constructed; based on the lithology of the area. Well assembly is so designed that slotted pipe rest against the shallow and deeper aquifer.

  If the aquifer is available at greater depth say more than 20 m, a shallow shaft of 2 to 5 m diameter and 3-5 metres deep may be constructed depending upon availability of runoff. Inside the shaft a recharge well of 100-300 mm dia is constructed for recharging the available water to the deeper aquifers. At the bottom of the shaft a filter media is provided to avoid choking of recharge well.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS:

a) Taking up artificial recharge projects to augment the resource availability in Jehanabad district

b) Optimal development of irrigation intensity by developing ground water available for future uses.

c) Adopting modern techniques of irrigation involving less water use.

d) Creating public awareness for conserving ground water through awareness camps, NGO's and mass media.

Problems:

Recurrence of drought and limited water resource are some of the problems in the district.

7.0 MASS AWARENESS AND TRAINING PROGRAMME

Till date, one two-day training programme has been organized in Jehanabad district.

8.0 AREA NOTIFIED BY CENTRAL GROUND WATER AUTHORITY/ STATE GROUND WATER AUTHORITY

As all blocks fall under safe category, no block has been notified by CGWA/SGWA.

9.0 RECOMMENDATIONS

- The overall stage of ground water development of the district is 64 %, however, scope for further development of ground water exist in the district.
- Small and marginal farmers can opt for shallow tubewells (30-50 m tapping 10-15 m granular zones with an expected discharge of 20 m^3/hr) while deep tubewells (150 m depth tapping 20-30 m granular zone between 90 and 140 meters with an expected discharge of 50-80 m^3/hr) can be adopted under farmers cooperative.
- Restoration and revival of traditional 'a*har-pyne*' system (water conservation structures) may be taken up on priority basis for enhancing the ground water potential of the district.

TABLE NO.-01

DISTRICT : **JEHANABAD**

Sl.No.	Location/ Block	Depth Drilled mbgl.	Length of Casing pipe/ Depth const. m.	Granular/ Zone/ fracture Tapped m.	Static Water level m. bgl.	Discharge m^3/hr.	Drawdown m.	Specific Capacity m^3/hr./m.	Trans-missivity m^2/day	Storativity	Diameter of assembly mm.	Formation	Quality of Water	Year	Status of Handing Over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	JEHANABAD $25^0$12'40" $84^0$57'30" EW	147.3	-	097.00-107.00 113.00-125.00 129.00-140.00	4.57	76.78	9.44	-	120.82	-	-	-	-	Mar-97	F.O.C.
	JEHANABAD BAZAR SAMITI OW	129	127	093.00-099.00 111.00-123.00	4.57	76.78	9.44	-	120.82	-	-	-	-	1997	