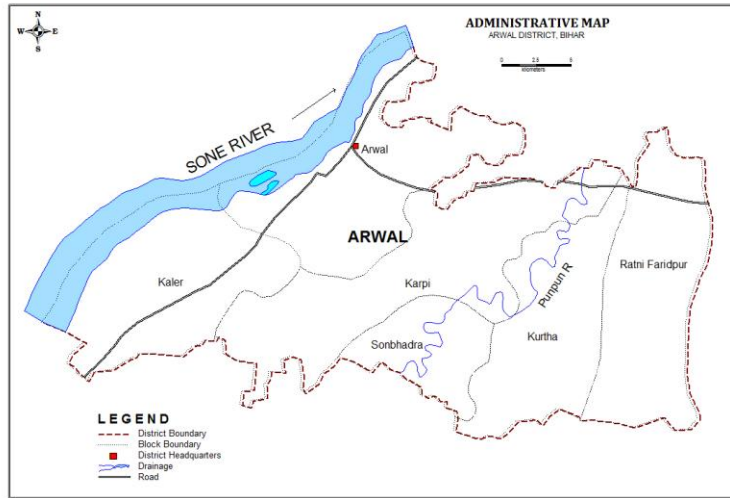




भूजल सूचना पुस्तिका अरवल जिला, बिहार

Ground Water Information Booklet
Arwal 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

सितंबर 2013

September 2013

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ARWAL DISTRICT AT A GLANCE

Sl. No.		Statistics
1.	GENERAL INFORMATION	
	I Geographical Area (Sq. Km.)	637
	II Administrative Divisions No. of Panchayats/Villages Number of Tehsil/Block	1 (Arwal) 65/335 5
	III Population (As per 2011 Census)	Total: 700843 Rural: 648994 Urban: 51849
	IV Average Annual Rainfall (mm)	1028
2	GEOMORPHOLOGY	
	Major Physiographic Units	1. Flat Indo-Gangetic Alluvium Tract
	Major Drainages	Sone, Punpun
3	LAND USE	
	i) Forest Area	Nil
	ii) Net Area Sown	361.98 sq.km
	iii) Total Cropped Area	452.47 sq. km
4	MAJOR SOIL TYPES	Inceptisols, Entisols
5	PRINCIPAL CROPS	Wheat, Maize, Paddy
6	IRRIGATION BY DIFFERENT SOURCES (Area in hectares)	
4	Dugwells	-
	Tubewells/Borewells (STW)	22000
	Tanks/ponds	Nil
	Canals	18000
	Other Sources	6000
	Net Irrigated Area	35000
	Gross Irrigated Area	46000
7	NUMBER OF GROUND WATER MONITERING WELLS OF CGWB (2011)	
	No. of Dug wells	06
	No. of Piezometers	Nil
8	PREDOMINANT GEOLOGICAL FORMATIONS	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	2 – 4.6 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)	Nil
	Depth Range (m)	-
	Discharge (m³/hr)	-
	Storativity (s)	-
	Transmissivity (m²/day)	-
11	GROUND WATER QUALITY	
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	Nil
	Type of Water	Potable
12	DYNAMIC GROUND WATER RESOURCES (as on 31st March 2009) in mcm.	
	Annual Replenishible Ground Water Resources	216.07
	Net Annual Ground Water Draft	102.58
	Projected Demand for Domestic and Industrial Uses up to 2025	16.39
	Stage of Ground Water Development	47.6%
13	AWARENESS AND TRAINING ACTIVITY	
	One day Mass Awareness Programme Organized	One
	Date	03/03/2003
	Place	Kurtha
14	GROUND WATER CONTROL AND REGULATION	
	No. of Of 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	

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1.0 INTRODUCTION

1.1 Administrative Details

Arwal district is spreading over an area of 637 Sq. Km. The district has one sub-division-Arwal. The district is divided into five administrative blocks mainly Arwal, Kaler, Karpi, Kurtha and Suryapurvanshi. The district is bounded by the north Patna and Bhojpur, South Aurangabad and Gaya, East Jehanabad and west by Bhojpur and Rohtas. The total population of Rohtas District as per 2011 census is 700843. The rural population is 648994 and urban population 51849.

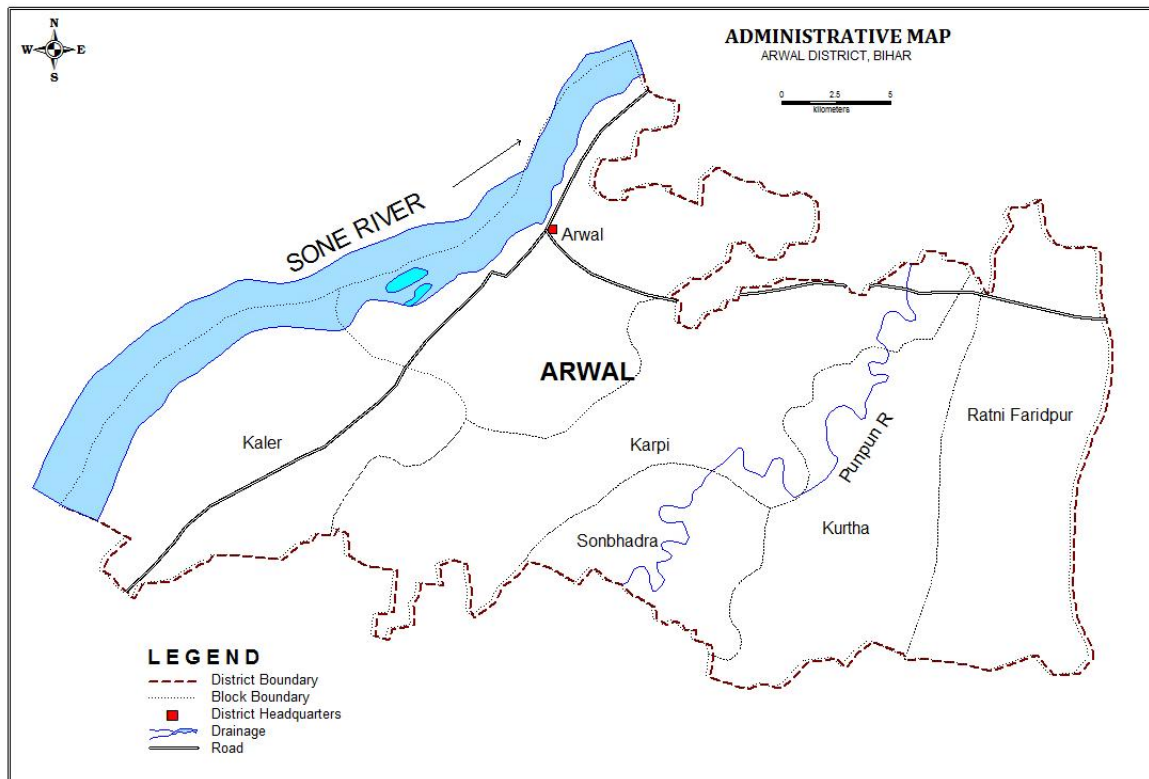


Fig-1. Administrative map of Arwal District

1.2 Basin/Sub-Basin and Drainage

The district falls under Punpun sub-basin of the Ganga basin. The drainage network in the district is represented by river Punpun emanating from southern plateau (Palamu District).

1.3 Agriculture 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 (2009-10) are given below:-

Area under forest: Nil

Area Under Cultivation:	129166 hectares
Barren & unculturable land:	2180 hectares
Culturable waste land:	2180 hectares
Permanent pastures:	151hectares
Other fallow land:	1632 hectares
Current fallow:	5804 hectares
Net area sown:-	41732
Gross cropped area;	53999 hectares
Cropping Intensity-	129.4
Net area irrigated by different sources:	35000 hectares

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

The principal crops of the districts include paddy, wheat and maize. As per available statistic out of the gross crop area of 53999 hectares, the net area irrigated by different sources like tubewells, canals etc are 35000 hectares.

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 6 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. Mass awareness and training programmes were organized in the district.

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 cold spell starts from December and continues till end of February.

The monsoon sets in the end of June. The actual average rainfall of July is 147.6 mm and of August is 168.2 mm respectively. The months of July and August receive the

maximum rainfall when average monthly normal rainfall of 293.1 mm and 310.2 mm is recorded. The annual normal rainfall of the district (1901-1970) is 1027.3 mm.

3.0 GEOMORPHOLOGY AND SOIL TYPES

Arwal district is characterized by flat quaternary alluvial plain. With average surface elevation of 100 meter about mean sea level.

The soils of the district belong to two classes- Entisols (Younger alluvial soils) and Inceptisols (Calcareous alluvial soils). The soils of the district is rich in nitrogen and calcium and thus are fertile.

4.0 GROUND WATER SCENARIO

4.1 Water Bearing Formations

The district is underline by vast tract of flat Indo Gangetic Alluvium of quaternary edge. The alluvial sediments are made up of gavel sands, Silk and clay. The gravels and the sand layers are good ground water repositories.

Thickness of the alluvial deposit is not precisely known due to lac of exploratory drilling. However the thickness of the alluvium more than 140 m as per as exploratory drilling in adjacent Jehanabad district is concerned. The potential of tubewells within 50 m bgl is expected to be 15-20 m³/hr. The yields potential of tubewells deeper aquifer in 140 m bgl is expected to be around 80m³/hr. The drilling information from the surrounding areas and the skate agencies reveal that shallow thin aquifers exist within 50 m depth which may yield around 20 m³/hr.

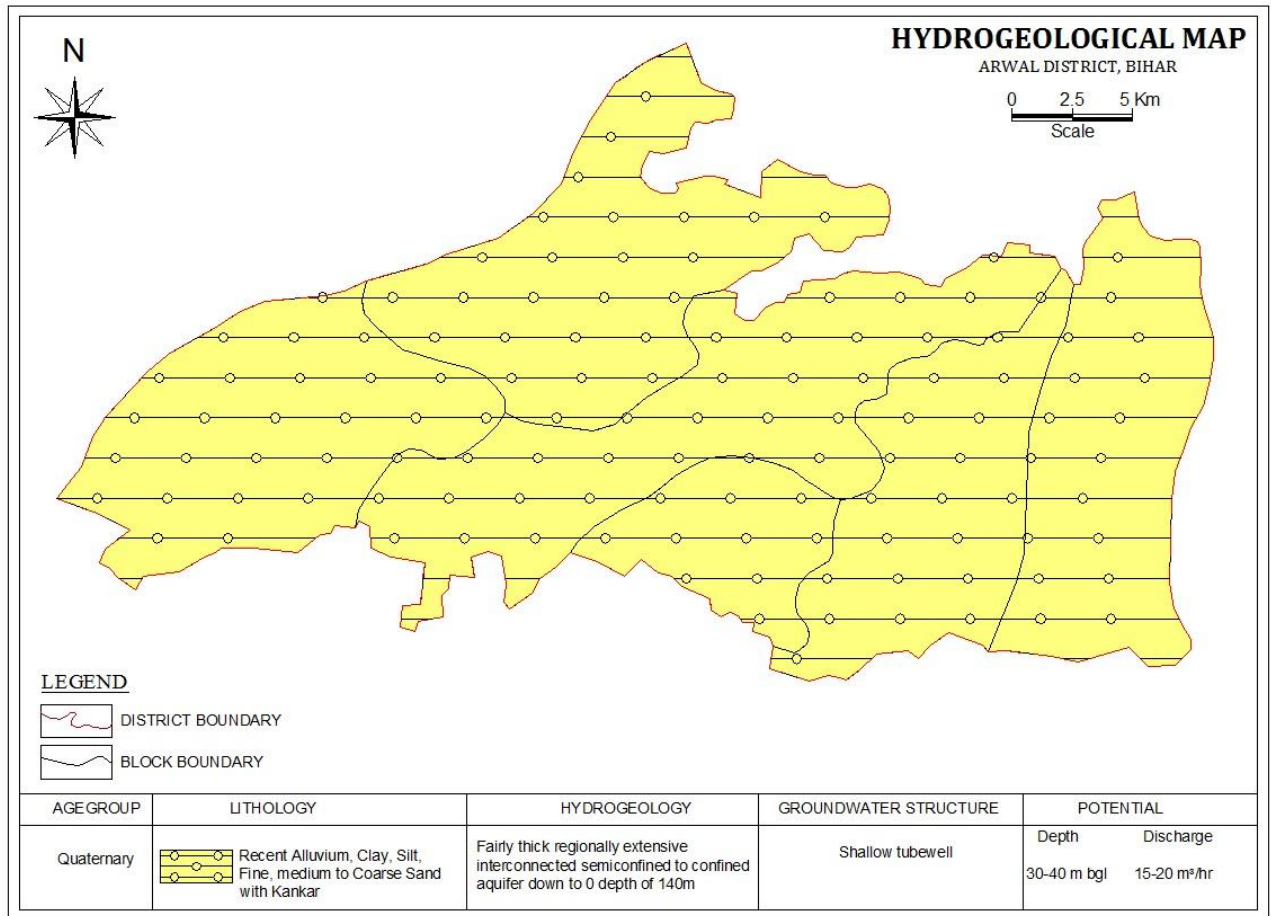


Fig-3. Hydrogeological map of Arwal district, Bihar

4.2 Depth to Water Level

In order to assess the temporal and spatial behaviour of ground water levels over the years 6 ground water monitoring wells were monitored during pre- and post-monsoon periods in the year 2011



DEPTH TO WATER LEVEL (MAY - 2011)

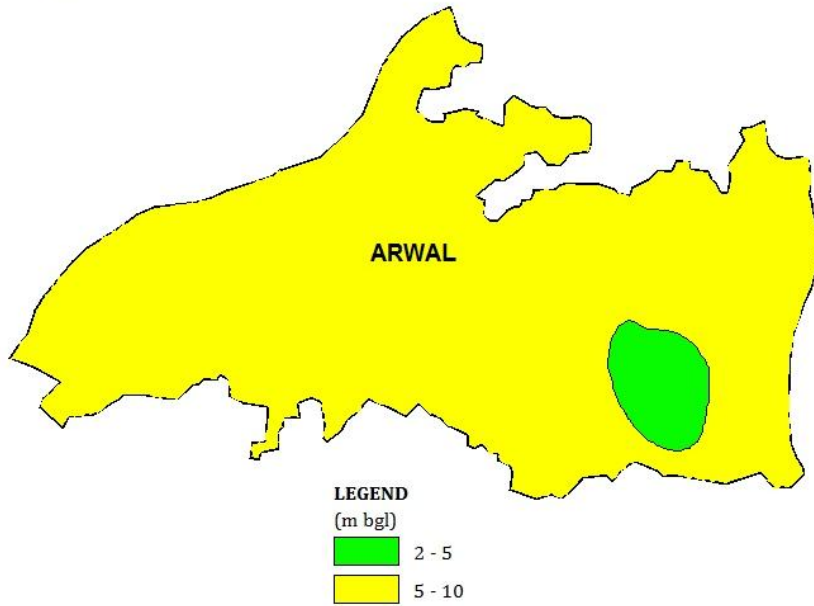


Fig-3. Pre- monsoon depth to water level map of Arwal district



DEPTH TO WATER LEVEL (NOVEMBER - 2011)

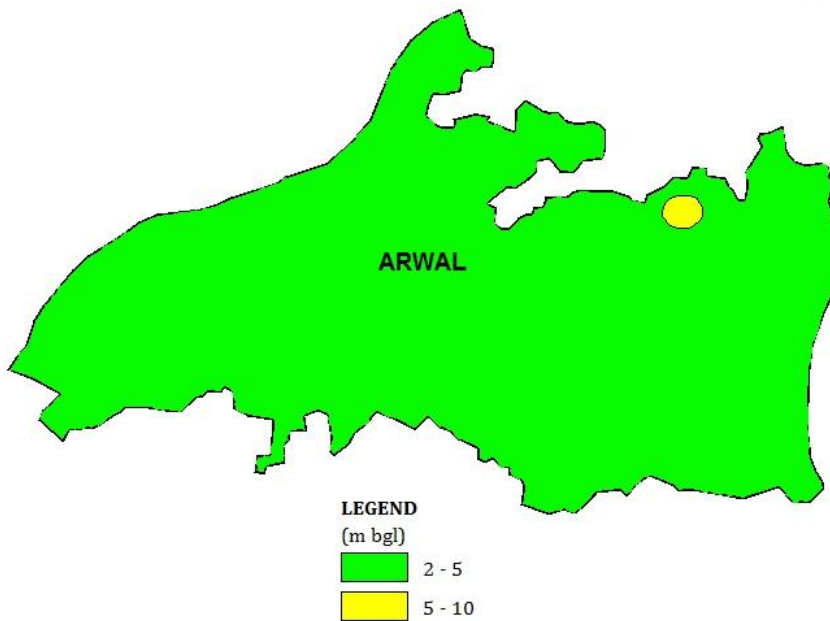


Fig-4. Post- monsoon depth to water level map of Arwal district, Bihar.

From the study of the depth to water map (Figure-2), it is evident that ground water level during pre-monsoon period mainly varies between 5 to 10 m below ground level in the major part of the district. Shallower ground water levels (>5 m) were observed in the south-eastern parts of the district.

From the study of the depth to water map (Figure-3), it is conspicuous that ground water level during post-monsoon period mainly varies between 2-5 m below ground level in the major part of the district. Deeper ground water levels (5-10) were observed over a small patch in the north-eastern part of the district.

4.3 Ground Water Quality

Ground water in the phreatic aquifers in Arwal district is slightly alkaline in nature. The specific conductance of ground water in phreatic zone during pre-monsoon, 2011 was in the range of 680 -1180 $\mu\text{S}/\text{cm}$ at 25°C. 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 ground water in the district is with in required desirable limits and hence potable.

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

SN	District	Location	EC (μs @25°C)	pH	CO ₃ ²⁻	HCO ₃ ⁻	Cl ⁻	Ca ²⁺	Mg ²⁺	TH	Na ⁺	K ⁺
					(in mg/lit)							
1	Arwal	Arwal1	1180	7.26	0	512	103	68	32	300	90	71
2	Arwal	Kurtha bdo	680	8.00	0	238	74	50	17	195	59	6

4.4 Ground Water Resources

The net annual replenishable ground water resource of Arwal district as on 31st March 2009 works out to be 21607 ha.m. The net annual draft for all uses works out to be 10258 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 1639 ha.m. The overall stage of ground water development is 47.6%. The stage of ground water development is highest in Kurtha (78.1%) and lowest in Kaler (27.3%). As stage of ground water development in all the blocks are less than 70% except Kurtha (78.1%), and there is no long-tem decline in water levels, all the remaining

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 .

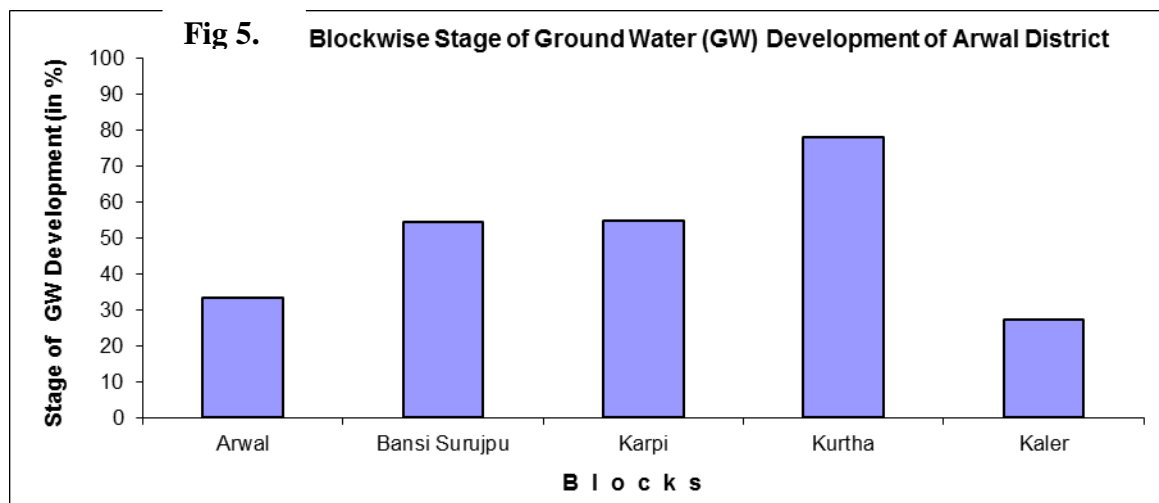


Table 3. Blockwise Dynamic Ground Water Resource of the Arwal district (2008-2009)

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	Arwal	4636	1318	231	1549	364	2953	33.4
2	Bansi Surujpu	2765	1398	109	1507	171	1196	54.5
3	Karpi	6408	3227	289	3515	456	2726	54.9
4	Kurtha	3123	2258	180	2439	285	580	78.1
5	Kaler	4675	1045	230	1275	363	3267	27.3
	Total	21607	9247	1038	10285	1639	10722	47.6

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 Fig-5

From the table it has been observed that stage of ground water development ranges from 27.3% (Kaler block) to 78.1 % (Kurtha block). Out of 5 blocks, only Kurtha block have stage of development more than 70%.

All other blocks in the districts fall 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. To allow aquifer 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 dugwells are being used for irrigation arable land. As per information 22000 hectares are being irrigated by means of groundwater. The gross ground water draft for the area has been estimated as 10285 ham.

In the district, dugwells, shallow tube wells and deep tubewells 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 in urban areas are as follow:

- (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, the use of trench/pits is made 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.

In rural areas abandoned dugwells, tubewell may be used for recharging shallow aquifers.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS:

No ground water related problems as so reported in the district.

7.0 MASS AWARENESS AND TRAINING PROGRAMME

Till date one mass awareness was organized at Village Sachai, Kurtha block of the district.

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

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

9.0 RECOMMENDATIONS

- As the overall stage of ground water development of the district is only 47.6 %, sufficient scope exist for further development of ground water 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 m³/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 m³/hr) can be adopted under farmers cooperative.

- Small part of area in Arwal block and almost half of the Kurtha and Kinjer are prone to water logging during post-monsoon season. As such consumptive use of surface of ground water is recommended in these area for better management of water resources.