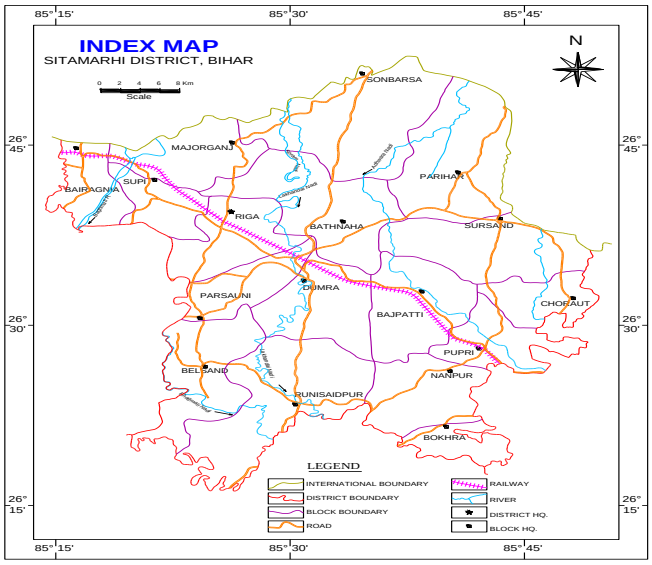
भूजल सूचना पुस्तिका

सीतामढ़ी जिला, बिहार

Ground Water Information Booklet

Sitamarhi 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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SITAMARHI DISTRICT AT A GLANCE

Sl. No.		Statistics
1.	**GENERAL INFORMATION**	
	I. Geographical Area (Sq. Km.)	2185.17
	II. Administrative Divisions **No. of Panchayats/Villages** **Number of Tehsil/Block**	3 273/877 17
	III. Population (As per 2011 Census)	Rural: 3233076 Urban: 190498
	IV. Average Annual Rainfall (mm)	1267
2	**GEOMORPHOLOGY**	
	Major Physiographic Units	Gangetic Alluvium
	Major Drainages	Bagmati, Lakhandei and Adhwara
3	**LAND USE**	
	a) Forest Area	Nil
	b) Net Area Sown	1340.54 sq.km
	c) Cultivable Area	2055.66 sq. km
4	**MAJOR SOIL TYPES**	Paleustalfs, Haplustalfs, Rhodustalfs, Udifluvents.
5	**PRINCIPAL CROPS**	
6	**IRRIGATION BY DIFFERENT SOURCES (Area in hectares)**	
	Dugwells	0
	Tubewells/Borewells (STW)	50000
	Tanks/ponds	3000
	Canals	2000
	Other Sources	1000
	Net Irrigated Area	57000 (42.52 % of net sown area)
	Gross Irrigated Area	78000
7	**NUMBER OF GROUND WATER MONITERING WELLS OF CGWB (2011)**	
	No. of Dugwells	07
	No. of Piezometers	Nil
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	Alluvium
9	**HYDROGEOLOGY**	
	Major water bearing formations	Alluvium
	Pre-monsoon Depth to water level during 2011	2.5 – 3.9 m bgl
	Post-monsoon Depth to water level during 2011	1.5 – 2.68 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 (m^3/hr)	-
	Storativity (s)	-
	Transmissitivity (m^2/day)	-
11	**GROUND WATER QUALITY**	Good for drinking and irrigation
	Presence of Chemical constituents more than the permissible limit (e.g.EC, F, As, F)	EC.
	Type of Water	Potable
12	**DYNAMIC GROUND WATER RESOURCES (as on 31st March 2009) in mcm.**	
	Annual Replenishible Ground Water Resources	750.65
	Net Annual Ground Water Draft	331.48
	Projected Demand for Domestic and Industrial Uses up to 2025	86.62
	Stage of Ground Water Development	42.2%
13	**AWARENESS AND TRAINING ACTIVITY**	Nil
	One day Training Programme Organized	Nil
	Date	
	Place	
	No. of Participants	
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**	Water logging at few places.
	Note: Latest available data may be incorporated	

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1.0 INTRODUCTION

1.1 Location, Area and Administrative Details

Sitamarhi district, located in the northern part of Bihar State was carved out the old Muzaffafarpur in the year 1972. The district is an acclaimed pilgrim centre and boasts of its important position in the mythological accounts for being the birth place of the Hindu goddess Sita. It is divided into 3 sub-divisions and 17 blocks and extends between north latitudes 26^0-17' 19'' and 26^0-57' 33" and east longitudes 85^0-10'-01" and 85^0-47'22" falling in the Survey of India toposheet no. 72 F. It the north it shares international boundary with Nepal and is bounded in the east by Madhubani and Darbhanga district, in the west by East Champaran and in the south by Muzaffarpur district. It is one of the economically backward districts of the country with recurrent flood havocs making life tough as every year people are forced to abandon their villages and take shelter in makeshift tents. The curse of Bagmati, which changes its course every year, has impaired the effort of the government in improving the status of life of downtrodden.

As per the 2011 Census, the total population of the district stands at 34,23,574 with a population density of 1492 persons per Sq Km.

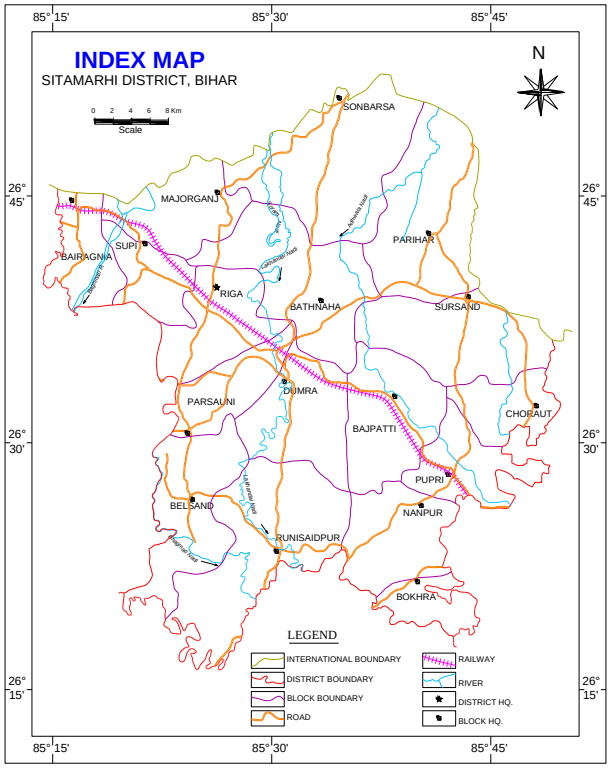

Figure 1: Administrative map of Sitamarhi district, Bihar with block boundaries road (rail) networks.

1.2 Basin/Sub-Basin and Drainage

The district forms part of the Gangetic Plains and is principally drained by Bagmati River which enters the district after emerging from the Himalayan foothills and brings in huge amount of silt. The network of other ephemeral streams which drains the district are Lakhandei, Adhawara and Marha etc all of which enters the district from Nepal. The curse of Bagmati, which changes its course every year, has impaired the effort of the government in improving the status of life of downtrodden.

1.3 Agriculture and Irrigation practices

Agriculture is the mainstay of the population and nearly 80% of the population is engaged in agricultural pursuits. The four main cropping seasons in the district are *Bhadai, Agahani, Rabi* and *Garma*. Paddy, wheat, pulses and oil seeds are the major crops grown in the upland areas while in the lowland areas only paddy is grown. In the *'diara'* lands the rabi crops are grown.

1.4 Studies/ activities carried out by CGWB

Central Ground Water Board has established five Hydrograph Network Stations which are primarily dug wells being used for monitoring of water level. From these stations monitoring is carried out four times every year in order to study the general ground water trend in the district and water quality monitoring is made once every year. The district has been covered by Systematic Hydrogeological Survey by CGWB during the year 1975-76 followed by reappraisal survey. Information on aquifer potential is available from the exploratory wells constructed by ETO and State agencies which has been made use of in this booklet.

2.0 CLIMATE AND RAINFALL

The climate of the district is sub-tropical to sub-humid in nature. Hot weather commences from the month of March when hot westerly winds often accompanied by dust storms begin to blow during the day while during the night the wind blows from east and the temperature is comparatively low. Rain sets in during the third week of June and continues till September. Rainfall normally ranges from 1100 to 1370 mm. The district also receives some winter rains which improves the prospects of rabi cultivation. Humidity is recored between 68 and 83%.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

The district forms part of the Indo- Gangetic Plains and is primarily a flat alluvial terrain with a masterly slope towards south and is devoid of any major topographic irregularity. The elevation varies from 88 m amsl in the north along the Nepal Border to 49 m amsl in the southern part. The only diversities that can be seen on the surface are those caused by the fluvial action of the rivers resulting in marshy lands, natural depressions etc. The Diara lands, Alluvial low tract (Immediate vicinity of the Bagmati River) and the Alluvial upland tract (away from the rivers and the interfluves) are the major geomorphic realms of the alluvial terrain of the district.

3.2 Soils

Entisols i.e light friable loam with higher proportion of sand and silt are the younger soils which fringes the eastern and northern bank of Bagmati in the central and western part of the district. These soils are deficient in nitrogen and phosphoric acid but generally rich in potash and lime. The calcareous alluvial soils (inceptisols) occur mostly in the northern part of the district. These are generally richer in lime content. In the southern part of the district, fairly matured soils with developed profiles (alfisols) which are subject to continuous leaching operation, leading to formation of calcareous nodules and ferruginous clay pans are found.

4.0 GROUND WATER SCENARIO

4.1 Water bearing formations

Sitamarhi district lies in the North Ganga Plain. It is underlain by thick potential aquifer zones down to the depth of 200 m below ground as per the exploratory findings made by ETO. Thick pile of alluvium consisting of various grades of sand, silt and clay together constitute the aquifer framework of the district. In the northern and north-eastern part of the district auto-flow conditions also exist which require a detailed investigation for precise delineation of the auto flow zones in the district. Ground water development can be made from both shallow as well as deep tube wells can be constructed to meet the irrigation requirement and potable water supply.

Shallow tube well can be constructed upto 50 m depth tapping granular zones between 20 and 40 m with a yield of 35- 50 m^3/hr for a modest drawdown of 3 to 6 m. The area in the close vicinity of Bagmati, Bagmati purani dhar, Lakhandei, Adhaura and Marha Rivers are suitable for sinking

of shallow tube wells. Deep tube wells constructed upto 120 m bgl tapping 20-30 m granular zone below the depth of 50 m can yield upto 150 m^3/hr for drawdown upto 7 m. PVC or MS pipes should be used. Water logging is also found in various parts of the district. The hydrogeological information is summarized as under

Local aquifers and related information

Depth range of shallow aquifer (in m bgl) *10-50 in general*

Depth range of deeper aquifer (in m bgl) *50-200 in general*

Yield potential of deeper aquifer (discharge) *100-200 m^3/hr*

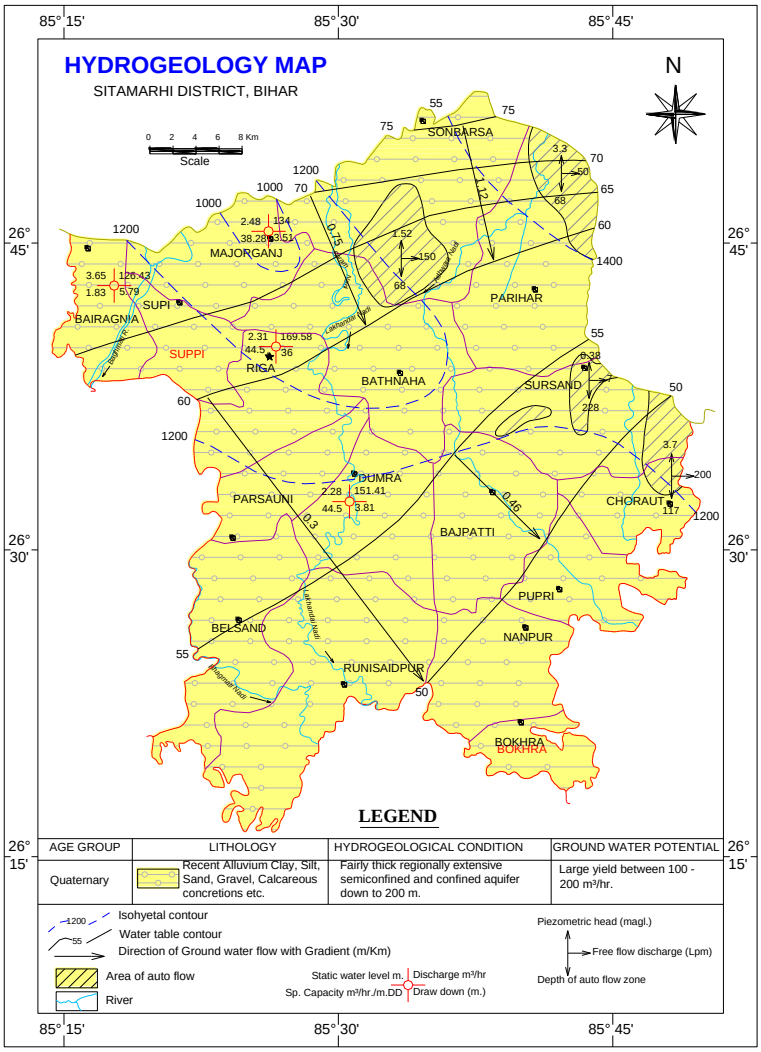

Figure 2: Hydrogeological map of Sitamarhi district, Bihar showing Quaternary Alluvium with their yield potential. Electrical conductivity of groundwater has been represented by contours.

4.2 Depth to Water Level

The pre-monsoon water level data of the year 2011 reveals that the depth to water level in the district remains between 2.5 and 3.9 m bgl. During the post-monsoon, the depth to water

level was found varying from 1.5 to 2.68 mbgl. The depth to water level map for the pre and the post-monsoon season for the year 2011 is presented in Fig 3 and 4. Summarized details of the monitoring carried out during 2011-12 are presented in Table 1.

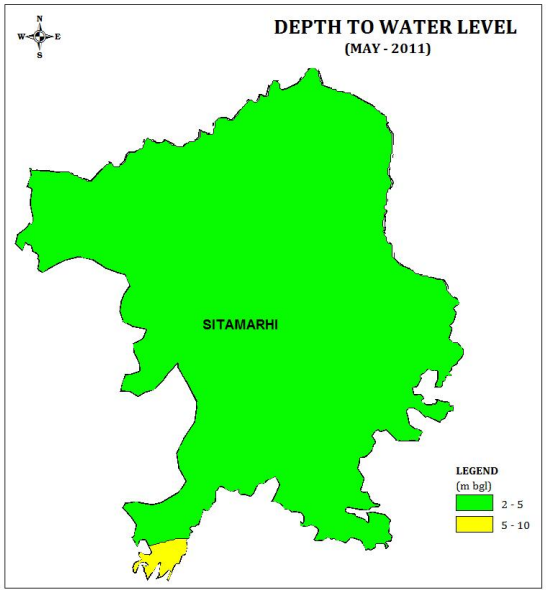

Figure 3: Pre- monsoon 2011 depth to water level contours in Sitamarhi district, Bihar.

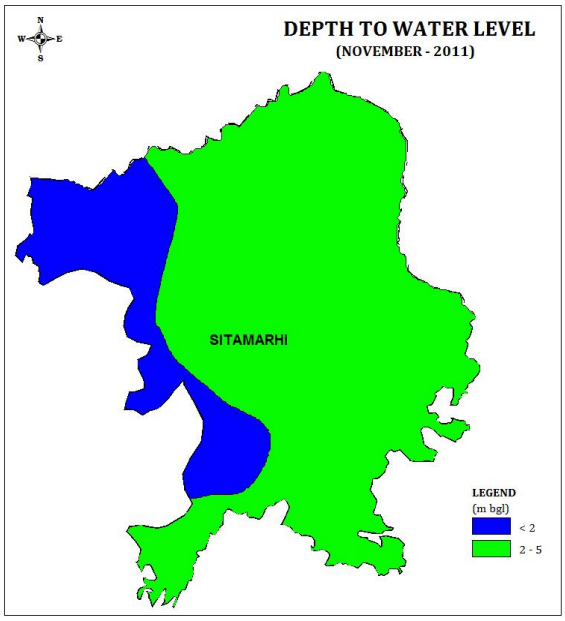

Figure 4: Post- monsoon 2011 depth to water level contours in Sitamarhi district, Bihar.

Table 1: Summarised details of the monitoring carried out in Sitamarhi district during 2011-12

District	Month	No. of HNS Wells measured	Depth to water level (m bgl)		0-2 m		2-5 m		5-10 m		10-20 m	
			Min.	Max.	No.	%	No.	%	No.	%	No.	%
SITAMARHI	May 2011	4	2.50	3.90	0	0.00	4	100.00	0	0.00	0	0.00
	August 2011	4	1.32	2.63	2	50.00	2	50.00	0	0.00	0	0.00
	November 2011	4	1.50	2.68	2	50.00	2	50.00	0	0.00	0	0.00
	January 2012	3	2.25	3.18	0	0.00	3	100.00	0	0.00	0	0.00

4.3 Ground Water Quality

Ground water quality monitoring from the hydrograph network stations of CGWB is carried out by CGWB once every year during the pre-monsoon season (May). The quality is thus representative of the phreatic aquifers in the area. The groundwater quality data for the year 2011 is presented in table 2 which reveals that groundwater is potable. Previous studies by CGWB have also indicated that the water quality is suitable for both domestic and agricultural activities.

Table 2: Ground Water quality of phreatic aquifer as per HNS data

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	Sitamarhi	Dheng	370	8.28	0	216	7	28	23	165	12	1
2	Sitamarhi	Jagawana	967	8.09	0	492	53	44	43	285	38	70
3	Sitamarhi	Khaira	624	8.06	0	289	46	32	18	155	45	33
4	Sitamarhi	Narwa	842	8.13	0	443	25	26	67	340	48	2
5	Sitamarhi	Sursand	978	8.38	12	498	46	28	55	295	45	65

The range of the chemical various constituents is summarized as under.

Electrical conductance : 370 to 978 micromhos/cm at 25^0C

pH : 8.06 to 8.38

Total Hardness as $CaCO_3$: 155 to 340 ppm

Calcium : 26 to 44 ppm

Magnesium : 18 to 67 ppm

Sodium : 12 to 48 ppm

Potassium : 1 to 70 ppm

Chloride : 7 to 53 ppm

Carbonate : NIL to 12

Bicarbonate : 216 to 498 ppm

4.4 Ground Water Resource of Sitamarhi (As per 31st march 2009)

Ground Water Resources

The net annual replenishable ground water resource as on 31st March 2009 works out to be 75065 ha.m. The gross annual draft for all uses works out to be 33148 ha.m. Allocation of ground water for domestic and industrial use for 25 years works out to be 8662 ha.m. The stage of ground water development is 44.2%. The stage of ground water development is highest in Bairgani (65.8%) and lowest in Sursand (19.2%). As stages of ground water development in all the blocks are less than 70% and there is no long-term decline in water levels, all the blocks are under safe category. The stage of ground water development and the block-wise ground water resource is given in table 3 and figure 5

Table 3: Blockwise Dynamic Ground Water Resource of Sitamarhi District (2008-09)

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	Bairgania	2289	1176	331	1506	312	802	65.8
2	Bajpatti	4367	1789	318	2107	551	2027	48.3
3	Bathnaha	6901	3760	363	4123	628	2513	59.7
4	Belsand	3101	1351	260	1612	437	1313	52
5	Bokhara	3374	926	190	1116	329	2118	33.1
6	Churaut	2152	162	113	275	196	1794	12.8
7	Dumra	6576	2443	618	3061	1050	3083	46.6
8	Majorjong	2534	1431	147	1578	254	849	62.3
9	Nanpur	4415	1194	268	1462	464	2757	33.1
10	Parihar	6558	1596	464	2059	802	4160	31.4
11	Parsauni	2446	1221	124	1346	215	1009	55
12	Pupri	3033	936	314	1250	533	1564	41.2
13	Riga	4893	2039	298	2336	515	2339	47.8
14	Runi saidpur	10015	3825	545	4369	943	5248	43.6
15	Sonbarsa	4967	1879	352	2231	609	2479	44.9
16	Suppi	2935	1672	178	1850	308	955	63
17	Sursand	4509	569	298	867	516	3424	19.2
	Total	**75065**	**27967**	5181	**33148**	**8662**	**38435**	**44.2**

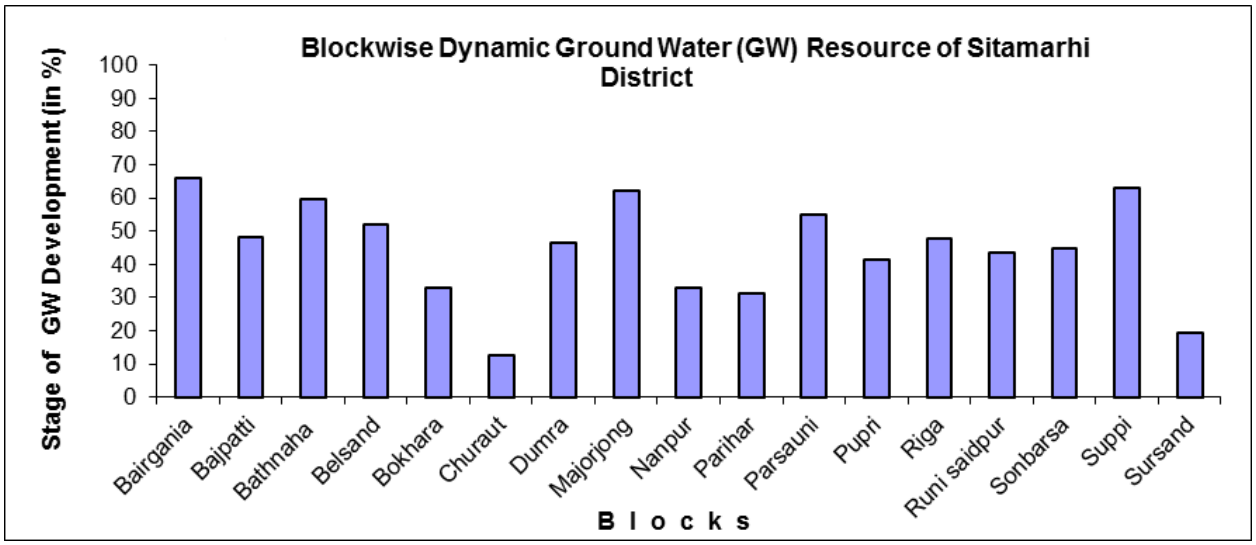

Fig 5: Block wise stage of ground water development of Sitamarhi district

4.5 Status of ground water development

As far as stage of ground water development is concerned, all the blocks in the district fall under safe category as per the norms of GEC, 1997. The highest Stage of development is 65.8 % for Bairangia Block.

As per available statistics, area irrigated by different sources constitute only 42.52 % of the net sown area, out of which ground water sources cover 37.29% and the remaining 5.23 % is served by canals, tanks and other sources. As per the 3rd Minor irrigation census of a total of 20,195 shallow tube wells are being used to develop ground water for irrigation.

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground water Development

As per the resource evaluation (31st march 2009) the average stage of ground water utilisaton in the district is less than 44.2 % and none of the blocks in the district comes under semi-critical/critical or over exploited category. The present infrastructural facilities yield 27967 ham of ground water for irrigation and there is a vast surplus replenishable ground water potential of 38435 ham to be tapped.

5.3 Water Conservation and artificial recharge:

No projects of water conservation and artificial recharge have been taken up by CGWB in the district.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS:

No major groundwater related problems have as yet been reported from the district

7.0 MASS AWARENESS AND TRAINING PROGRAMME:

Nil

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

Since all blocks of the district come under safe category from ground water development point of view, hence no area is notified either by Central ground water authority or State ground water authority till date.

9.0 RECOMMENDATIONS

- Sufficient scope exists for development of groundwater for agricultural development in the district as the overall stage of development is just 44.2%.

- Exploitation of ground water can be done through both Shallow and Deep tube wells. While the small and marginal farmers can opt for shallow tube wells, farmers' co-operative can opt for high discharge deep tube wells. Shallow tube well can be constructed upto 50 m depth tapping granular zones between 20 and 40 m with a yield of 35 to 50 m^3/hr for a modest drawdown of 3 to 6 m. The areas in the close vicinity of Bagmati, Bagmati purani dhar, Lakhandei, Adhaura and Marha Rivers are suitable for sinking of shallow tube wells. Deep tube wells constructed upto 120 m bgl tapping 20-30 m granular zone below the depth of 50 m can yield upto 150 m^3/hr for drawdown upto 7 m. PVC or MS pipes should be used.
- Water logging is an important problem that warrants attention. Conjunctive use of surface and groundwater can help manage the water logging problem to a great extent.
- The auto-flow zones in the northern and north-eastern part of the district needs to be precisely delineated as it can be of immense benefit for the farmers.