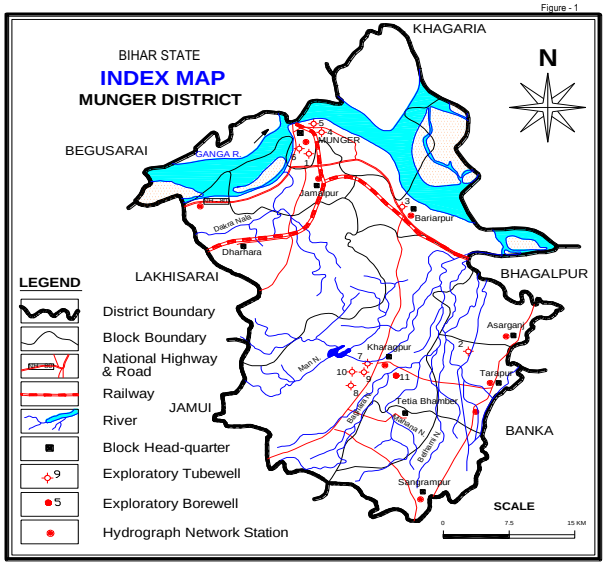
भूजल सूचना पुस्तिका

मुंगेर जिला, बिहार

Ground Water Information Booklet

Munger District, Bihar State

Figure - 1



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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UNDER SUPERVISION OF	-	Dr. K.K.Singh, Scientist'D'
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Sl. No.	ITEMS	Statistics	
1.	GENERAL INFORMATION		
	i) Geographical area (SqKm)	1419.7	
	Administrative Division		
	i) Number of Tehsil/ Block	09	
	ii) Number of Punchyat/Villages	903	
	iii) Population (As on 2011 Census)	1359054	
	iv) Average Annual Rainfall (mm)	1231	
2.	GEOMORPHOLOGY		
	Major physiographic unit:	Hill, Pediplain, Alluvial Plain	
	Major Drainages:	Ganga, Belharni, Man, Mahana	
3.	LAND USE (SqKm)		
	a) Forest area:	285.24	
	b) Net area sown:	468.69	
	c) Cultivable area:	646.91	
4.	MAJOR SOIL TYPE	Entisols and Alfisols	
5.	AREA UNDER PRINCIPAL CROPS	Paddy, Wheat, Lentils	
6.	IRRIGATION BY DIFFERENT SOURCES (Areas Sqkm and Number of Structures)	Area	No.
	Dugwell	0.43	-
	Tubewell/Borewell	266.23	-
	Tank/ponds	-	-
	Canals	133.16	-
	Other sources	-	-
	Net irrigated area	-	
	Gross irrigated area	399.83	
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (2011)		
	No of Dug wells	08	
	No of Piezometers	Nil	
9.	HYDROGEOLOGY		
	Major Water bearing formation	a) Hard rock/fissured formation of Quartzite and Phyllite. b) Unconsolidated Sediment of Alluvium Plain.	
	(Pre-monsoon Depth to water level during 2011) m bgl.	3.04 to 10.91	
	(Post-monsoon Depth to water level during 2011) m bgl.	0.68 to 8.55	
	Long term water level trend in 10 yrs (2002-2011) in m/yr		

10.	GROUND WATER EXPLORATION BY CGWB (As on 31-03-2013)	
	No of wells drilled (EW, OW, PZ, SH, Total)	19, 10, Nil, 01
	Depth range (m)	50-234
	Storativity (S)	$3.0X10^{-5}$ -$5.0X10^{-3}$
	Transmissivity (m^2/day)	10 - 500
11.	GROUND WATER QUALITY	
	Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe)	Fluoride (2-6 ppm)
	Type of water	Potable
12.	DYNAMIC GROUND WATER RESOURCES(as on 31st March 2009)- in mcm	
	Annual Replenishable Ground water Resources	309.07
	Net Annual Ground Water Draft	89.68
	Projected Demand for Domestic and industrial Uses up to 2025	28.88
	Stage of Ground Water Development	33.3%
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes organized	01
	Date:	30th March, 2005
	Place:	Town hall, Munger
	No of participant :	Over five hundred
	Water Management Training Programmes organized	Nil
14.	EFFORT OF RTIFICIAL RECHARGE & RAIN WATER HARVESTING	
	Project completed by CGWB(No & Amount spent)	Nil
	Project under technical guidance of CGWB (Numbers)	Nil
15.	GROUND WATER CONTROL AND REGULATION	
	Number of OE Blocks	Nil
	Number of Critical Blocks	Nil
	Number of Blocks notified	Nil
18	MAJOR GROUND WATER PROBLEMS AND ISSUES	Geogenic contamination of ground water with fluoride and source finding.

CONTENTS

Ground Water Information Booklet
Munger District, Bihar State

1.0 Introduction

1.1 Administration

The district is located in the southern part of Bihar state with Munger town as its headquarters on the southern bank of the river Ganga. The district has geographical area of 1419.7 sq km accounting for 3.3% of the Bihar state. It lies between 24^0 59' N to 25^0 30' latitudes and 85^0 16' to 86^0 42' E longitudes. The district is bounded on the north by Khagaria, on the west by Lakhisarai and Begusarai districts, in the east by Bhagalpur, while in south it is bounded by Banka and Jamui districts. The district is divided into three subdivisions and nine developmental blocks (figure-1) for administrative and development point of view. There are 903 villages in the district having total population of 1359054 as per census 20101

Munger is one of the historic towns of Bihar, known to be ruled by Karna. Its ruler Mir Kasim fought one of the last battles before East India Company captured the eastern India.

1.2 Basin/sub-basin, Drainage

The Munger district forms a part of Badua-Chandan, Sunder-Gumani sub-basin of the Ganga Basin. The Kharagpur Hill is a prominent landscape as a distinct watershed. Western half of Kharagpur hills forms part of Phalgu-Kiul Sub-basin. The district is having moderate to low drainage density. Dendritic and rectangular drainage patterns are dominating in the hilly regions, while in the plain area the pattern is parallel to sub-parallel. Major rivers of the district are Ganga, Man, Belharni and Mahana. The Ganga flows to the east, but it takes northward turn near Munger town. Other rivers flow towards NNE and join the Ganga. Except the Ganga River, all are ephemeral in nature, having meager water during lean periods.

1.3 Irrigation Practices

The agricultural activity is by and large confined to the traditional Kharif cultivation due to lack of adequate irrigation system. The principal crops of the district are Paddy, Wheat and Lentils. As per the statistics of the year 2004-2005 (Govt. of Bihar) the gross irrigated area is about 39983 ha. The cultivable area of district is 64691 ha where 26623 ha is irrigated by deep and shallow tube wells and 13316 ha by canals. Conjunctive use of surface and ground waters can bring the desired development in this water scarce district.

1.4 Studies/ activities carried out by CGWB

Considerable work has been done on hydrogeology of the district since independence. The Central Ground Water Board has carried out hydrogeological survey and exploration in the district. Under exploration programme a total of 17 nos. of wells have been drilled, where 11 wells are exploratory (Figure-1) and 06 are observation wells. Out of 17 wells 04 are located in alluvial areas, 12 in marginal alluvium and one in hard rock. Regular monitoring of nine hydrograph stations of the district is being carried out four times a year, since 1975 by CGWB (Figure-1). This has generated invaluable data on water level fluctuation and chemical quality of ground water. Ground water resources of the district have been estimated (GEC-1997, norm) in the year 2009. The estimation has highlighted the stage of ground water development as 33.3% in the district.

2.0 Rainfall and Climate

The average annual rainfall of the district is 1231 mm and about 80% of the rainfall is received during June to September by south-west monsoon. The climate of the district represents a transition between dry and extreme climate of northern India and the warm and humid of West Bengal. There are three distinct seasons in a year. The winter starts from November and last till end February. The summer starts by March end and lasts through May to mid June and the monsoon sets in thereafter which continues till September. In the summer, temperature rise up to 42^0C, while in winter it dips down 2^0C.

3.0 Geomorphology and Soil types

3.1 Geomorphology

The district has a diverse landscape ranging from hills to flood plains. The major geomorphic units are rocky upland, pediplain and alluvial plain (Figure-5).

a) The Kharagpur Hill tract: it constitutes dominantly elevated and rugged landmasses, except south surrounded on all sides by alluvial plains. The Ganga flows along its northern tip. The altitude of hills varies from 500 to 250 m a msl. It comprises mainly quartzite and phyllite of Kharagpur Formation. The rock of Kharagpur Formation has undergone multi phase tectonic deformation, which has given rise to many types of deformational structures. Thermal springs are common in Kharagpur Hills and these springs emerge from fissures in highly jointed or sheared quartzites.

b) Pediplain: represented by the area formed by coalescence of the pediment and thus forms rolling topography and comprises residual soil overlain by mixture of sheet wash deposits.

c) Alluvial Plain: Older Alluvial Plain is represented in major part of Tarapur, Asarganj and part of Sangrampur blocks and it is made up of sediments derived from the denudation of Chota Nagpur Plateau and Kharagpur Hills. The thickness of this alluvium in Khaira village is about 40m, while in the east it is reduced considerably. Northern part of the district is represented by Younger Alluvial Plain and confined within few km from the river Ganga. Locally, this is called Diara area. Relief of Diara area is level to very gentle undulating ground. The mighty Ganga meanders in these parts and usually these land masses are flooded during middle of July to the end of September. Alluvial thickness is more in diara area. A tube well drilled by CGWB up to a depth of 235m bgl, located at Heru diara village, confirms the huge thickness of sediments. Natural levee, flood basin (Tal) and crevasse splays are common landforms along the river Ganga. The relief of alluvial plain on an average is 30 to 65 m above mean sea level.

3.2 Soils

The Munger district consists mainly of Entisols and Alfisols type of soils under different lithological and pedogenic conditions. (a) Younger alluvial soil of entisols group of soil is restricted on either side of river Ganga, mainly on northern and southern Ganga plain. It is deficient in nitrogen, phosphoric acid and humus. Texturally these soils are sandy to loamy sand and pH value being on the alkaline side, it occurs mainly in diara area. (b) Older alluvial soils of alfisols group of soil are developed mainly in the marginal area along northern border of hard rock terrain i.e. south of Ganga. (c) Red sandy soil of alfisols group of soils occurs in major part of district especially in central part of the district. It has poor fertility and is suitable for high land crop.

4.0 Ground Water Scenario

4.1 Hydrogeology

Hydrogeologically, the district is divided into two parts (A) Hard rock/ Fissured formation (B) Unconsolidated / Porous formations (Figure - 5).

(A) Fissured Formation: This unit is made up of the rock of Chotanagpur Gneissic Complex (CGC) and Kharagpur Formation, which is mainly composed of granite gneisses, quartzite and phyllites. In general these rocks possess poor aquifers until or unless secondary porosities are

developed by means of weathering and or fracturing. Granite gneiss rocks are encounter in Khaira village at 40 m bgl. The exploratory data of this area reveals presence of sets of fractures and joints up to the depth of 100 m bgl. The fractures appear on the surface in the form of lineaments. These lineaments were delineated with the help of Satellite Image (Figure-5). The lineaments are potential areas for ground water exploration and recharge. Weathered residium, saprolite zone and fractures within 15-35 m bgl, constitute shallow aquifer. Ground water occurs under unconfined condition at shallow depth and semi-confined condition at deeper level.

(B) Porous Formation: The Quaternary alluvium constitutes this hydrogeological unit and occupies major part of the district. There is large variation in thickness of the alluvium due to uneven bed-rock topography. Porous formation comprising clay, silt and sand forms this unit. Occurrence of colluvial sediments is very common in marginal area. Aquifers in this formation are under unconfined to semi-confined conditions. CGWB has drilled 16 tube wells in this formation. Maximum thickness of alluvium encountered is 235m at Heru diara village of Munger block. Exploratory data indicate six to seven sets of good aquifers within the depth of 200 m bgl. In general, the depth of tube wells ranges from 50 to 235m bgl and the discharge varies from 2 to 45 lps (Table1).

There are eight hydrographs network station (HNS) in this district (Figure-1). These HNS are being monitored since 1975 by CGWB. Besides these wells State Ground Water Investigation Dept. govt. Bihar, also having key wells for seasonal monitoring. In pre-monsoon water level renges between 3.04 to 10.91 m bgl and in post-monsoon 2011 water level ranges between 0.68 to 8.55 m bgl. Long-term water level data (2001-2011) indicate no significant decline in water level. Depth to water level maps of pre and post-monsoons of the year 2011 are shown on figure no.2 and 3 respectively.

4.2 Ground Water Resources

Dynamic ground water resource of the district has been estimated (GEC-1997, norm) in the year 2009. There is a wide variation in the ground water potential of various hydrogeological units identified in the district. The net annual replenishable ground water resource of the district is 309.07 mcm and the gross draft is 89.69 mcm. Allocation for domestic and industrial requirement supply up to the year 2025 is 28.88 mcm. Stage of ground water development of district is 33.3%. All nine blocks of district fall under “Safe Category” indicating further scope of ground water development (Figure-4). Maximum ground water development is in Tarapur block (50.7%), while minimum is in Dharhara block (12.1%). Details of ground water resources of all blocks are given in Table no 1.

4.3 Chemical Quality of Ground Water

Chemical analysis of water samples collected from the HNS and exploratory wells reveals that the ground water is by and large suitable for drinking and irrigation purposes. In some villages of Kharagpur block such as Khaira, Ramankabad, Samda and Bhalwa Koul fluoride has been detected beyond the permissible limit of 1.5 ppm. In Khaira village fluoride is detected up to a depth of 60 m bgl within granite rock (2.6 ppm). Some phreatic aquifers are also affected with fluoride. In general, the pH of ground water ranges from 7.41 to 8.3, EC from 600 to 2300 (micro Seimens/cm), chloride from 21 to 234 ppm and fluoride from 0.5 to 4.22 ppm. EC contour and point value of fluoride and iron are shown on figure-5.

4.4 Status of Ground Water Development- Block wise

The occurrence and movement of ground water are controlled by diverse geology and landform of the district. An attempt has been made to summarized block wise information on suitable well type, prevailing depth, discharge range and suitable drilling method and other Information (Table – 2).

5.0 Ground Water Management Strategy

5.1 Ground Water Development

Most suitable area for ground water development is alluvial plain. Direct and reverse rotary drillings are suitable in this formation and by DTH rigs in hard rock area. Depth of weathering in these areas varies in general from 10 to15 m bgl. Detail information related to depth, discharge, drilling methods etc. are given in table -2.

5.2 Water Conservation and Artificial Recharge

The gross irrigated area of the district is about 60% of total cultivable area. Though the ground water development is low in overall sense scarcity of water affecting some part of the district as Water saving devises such as sprinkler and drip irrigation techniques would bring more area under irrigation. The district receives 1231 mm of annual rainfall on an average but most of rain water goes as run off. Construction of suitable artificial recharge structure will help to reduce the run off as well as it also recharge the aquifers and maintain the soil moisture of the area. Contour bunding, check dam, gully plug, percolation tank etc are some suitable structure in the hard rock area, while for porous formation recharge shaft and percolation tank are more suitable. Before construction of these recharges structures, selection of suitable site is required for getting better benefits

from these structures. Scope of artificial recharge area wise shown in figure -6.

6. 0 Ground Water Related Issue and Problems

The western part of the district is occupied by hard rock especially in Kharagpur, Dharhara and Jamalpur blocks. A major part of the rainfall goes as surface run off in hard rock areas, without recharging the aquifers, which leads to water scarcity in non-monsoon periods. Waterlogging, flood and river erosion are very common in Diara area.

In general, the chemical quality of ground water is potable and also suitable for irrigation purposes. Ground water of Khaira & Bhalwa Koul villages is affected by fluoride contamination. In these villages either potable water should be supplied form adjacent villages or defluorination plant should be established for safe drinking water.

7.0 Mass Awareness Programme and Training Activity

7.1 One Mass Awareness Programme (MAP) has been organized in Munger town on "Rain Water Harvesting & Ground Water Recharge" on 30th March 2005. Over five hundred participants from various govt. organizations, NGO and local people participated. Lectures on hydrogeology and exploration works of Munger district were delivered by the scientist of CGWB.

8.0 Area notified by CGWA/SGWA

All the blocks of Munger district are under "Safe Category" for ground water development point of view. So far no block has been notified by the Authority.

9.0 Recommendation

1. Ground water exploration has been done by CGWB in fluoride affected areas of Munger district indicate that all the potential fractures down to a depth of 100 m is contaminated by fluoride. The weathered zone tapped by the dug wells within 5 -15 m depths is also affected by fluoride contamination.

2. Community based fluoride removal plant can tackle the fluoride menace. There are numbers of fluoride removal techniques. Nalgounda technique is simple and effective.

3. Dilution of fluoride-contaminated water by rainwater harvesting is under investigation.

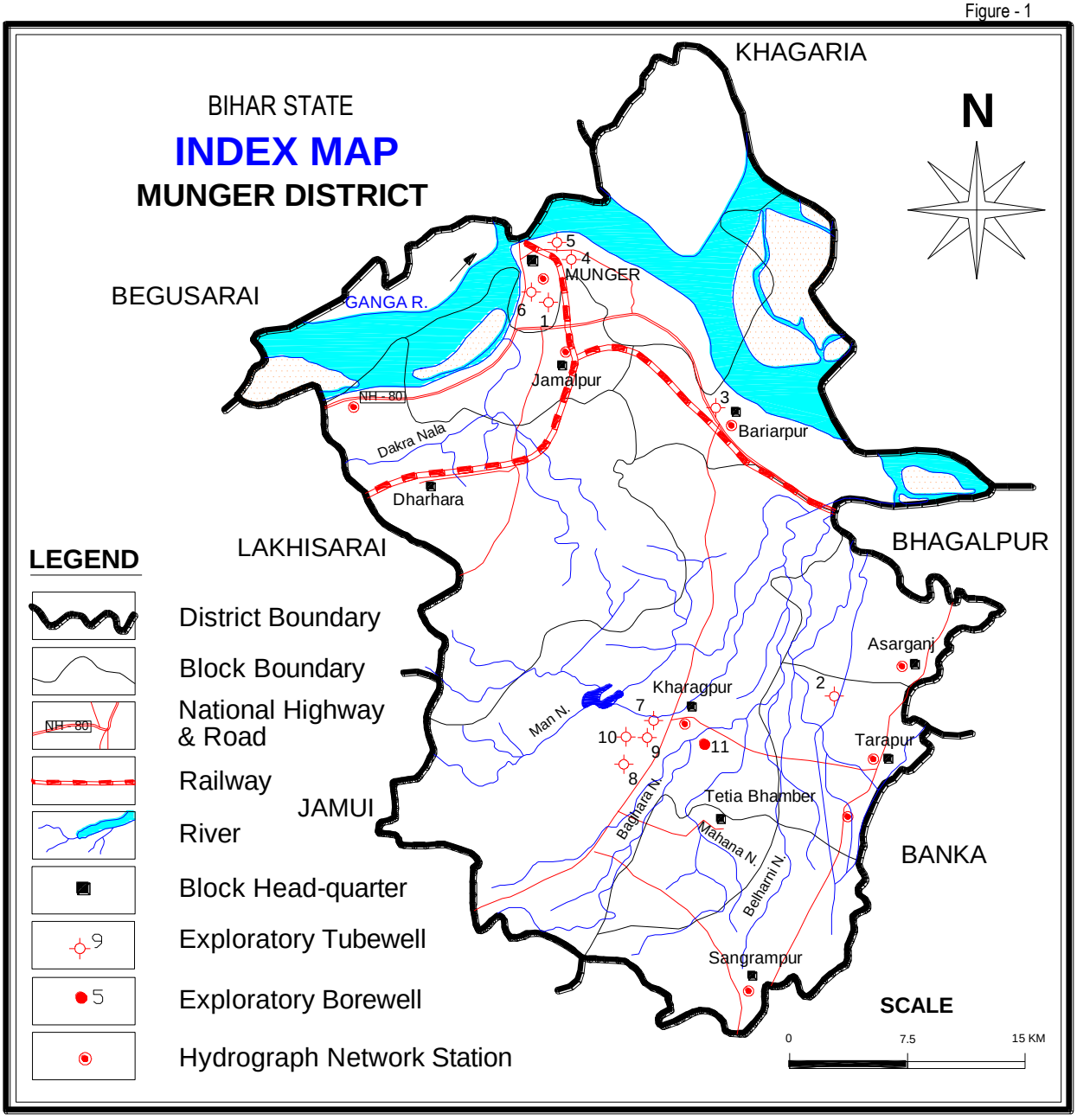
4. The stage of ground water development is around 33.3% indicating that there is a large scope for further ground water development however the artificial recharge including rainwater harvesting should be taken to augment the ground water reserve.

5. Suitable structure for artificial recharge in the area under porous formation are recharge shaft and percolation tank.

6. Suitable structures for artificial recharge in hard rock areas are contour bunding, check dam, gully plug, and percolation tank.

7. The district headquarter Munger to be taken up under artificial recharge of ground water, keeping in view of rapid increase in ground water draft. The ground water draft in Munger urban area is to the tune of 57.15 lakhs lpd. Roof top rain water harvesting to be taken up to recharge the aquifer in Munger urban area.

Figure - 1


BIHAR STATE
INDEX MAP
MUNGER DISTRICT
KHAGARIA
N
BEGUSARAI
GANGA R.
MUNGER
Jamalpur
Bariarpur
NH - 80
Dakra Nala
Dharhara
LAKHISARAI
BHAGALPUR
JAMUI
BANKA
Asarganj
Kharagpur
Man N.
Tarapur
Tetia Bhamber
Badhara N.
Mahana N.
Belharni N.
Sangrampur
LEGEND
District Boundary
Block Boundary
National Highway & Road
Railway
River
Block Head-quarter
Exploratory Tubewell
Exploratory Borewell
Hydrograph Network Station
SCALE
0
7.5
15 KM

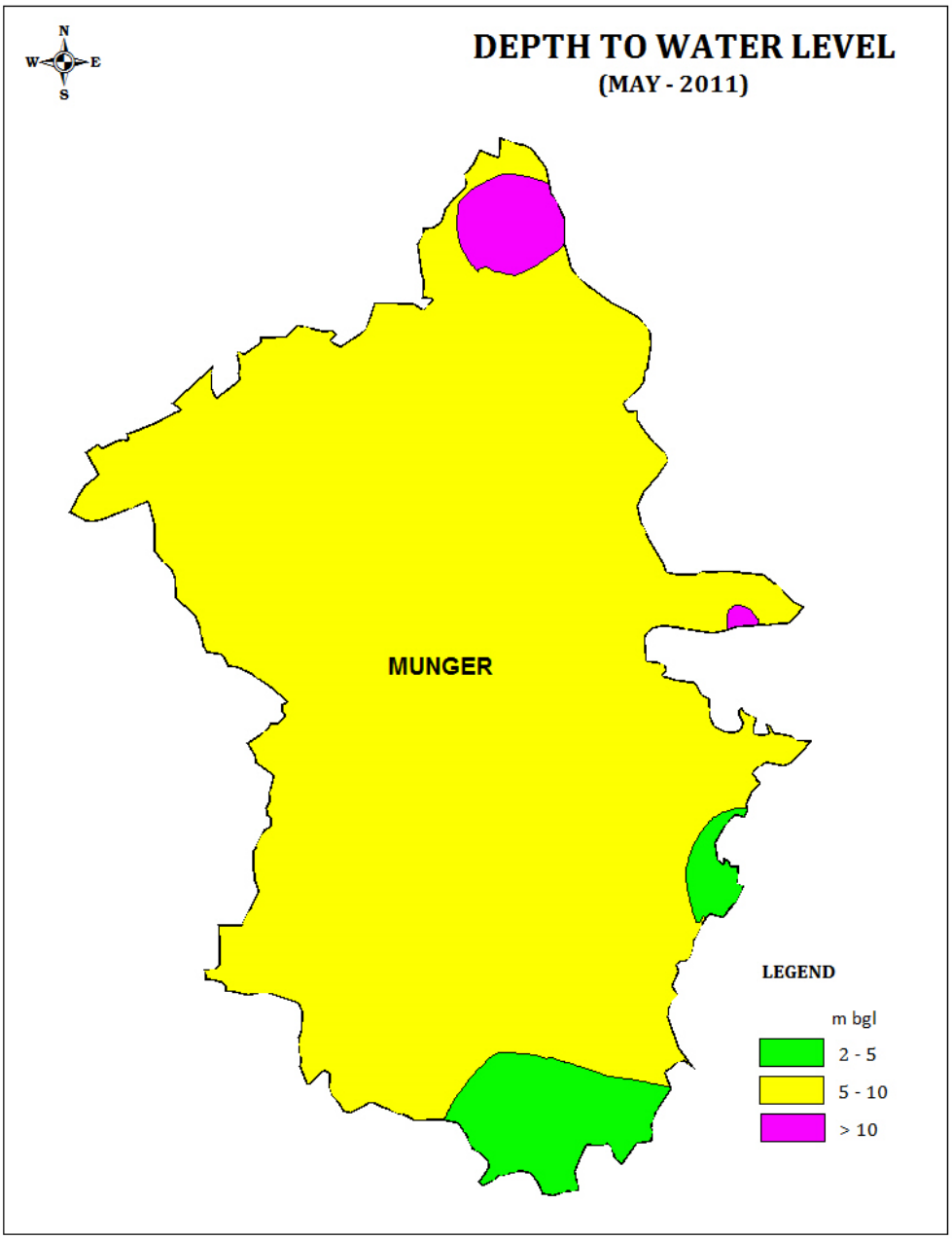


Fig. 2 Depth to water level map of pre-monsoon 2011.

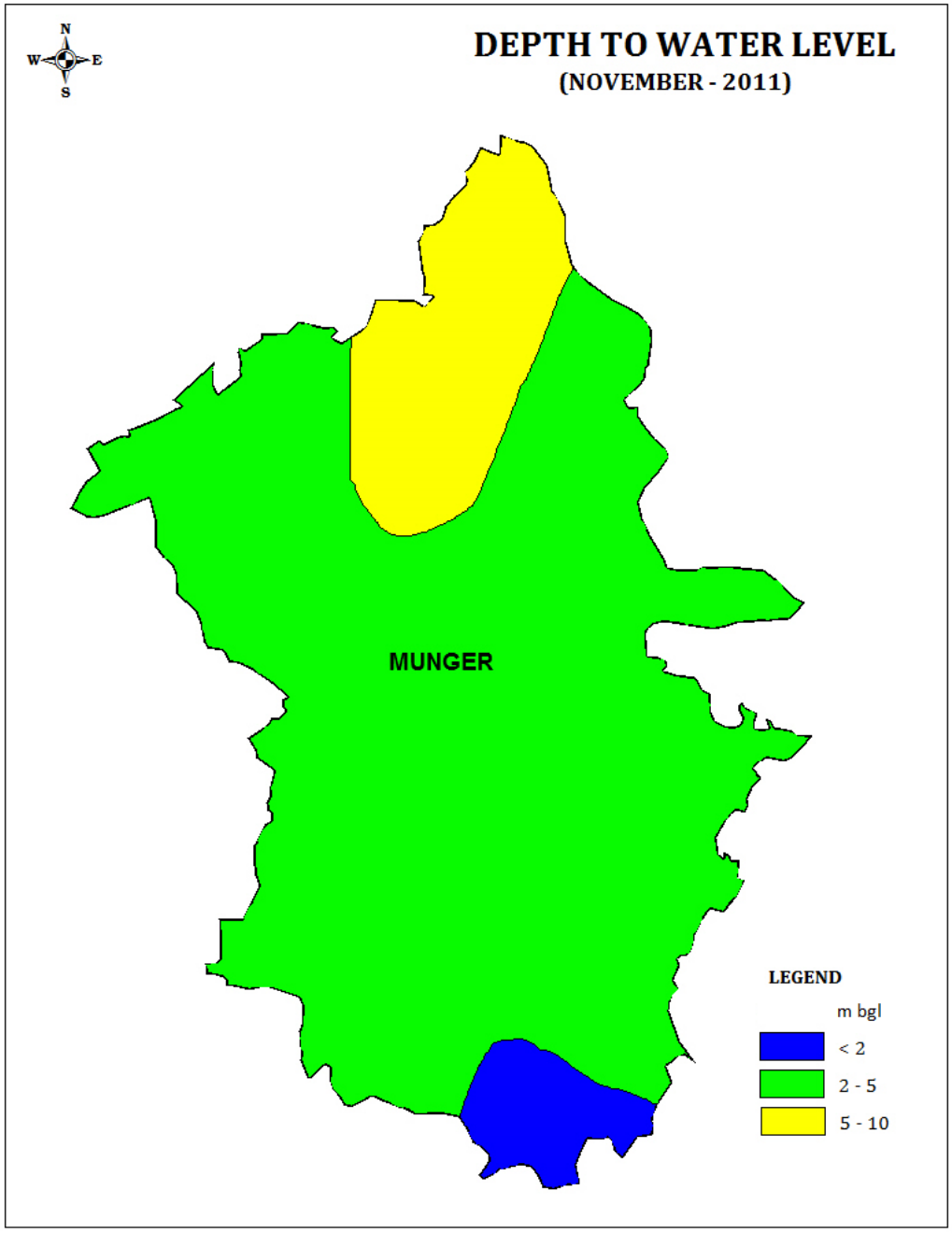


Fig. 3 Depth to water level map of Post-monsoon 2011

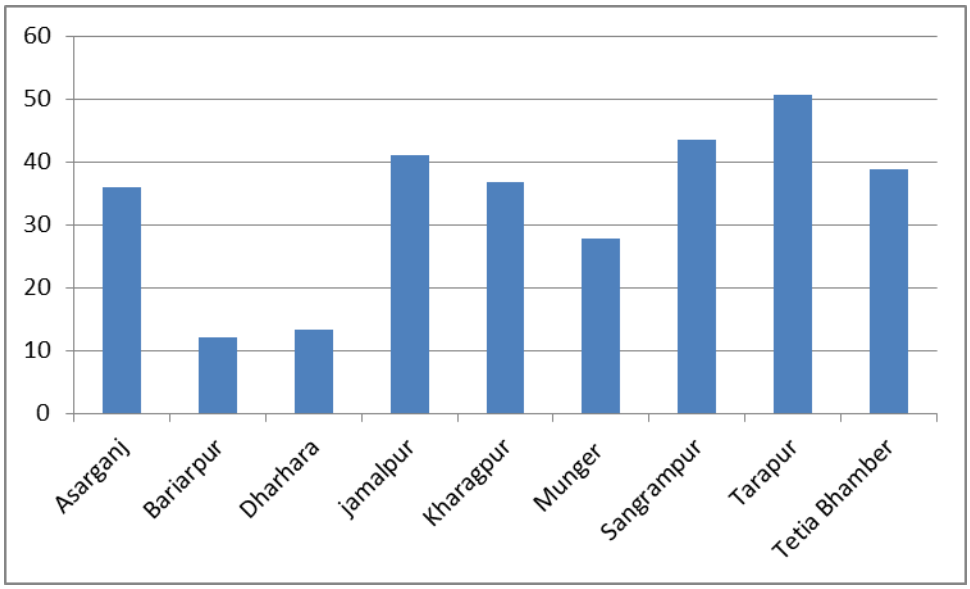
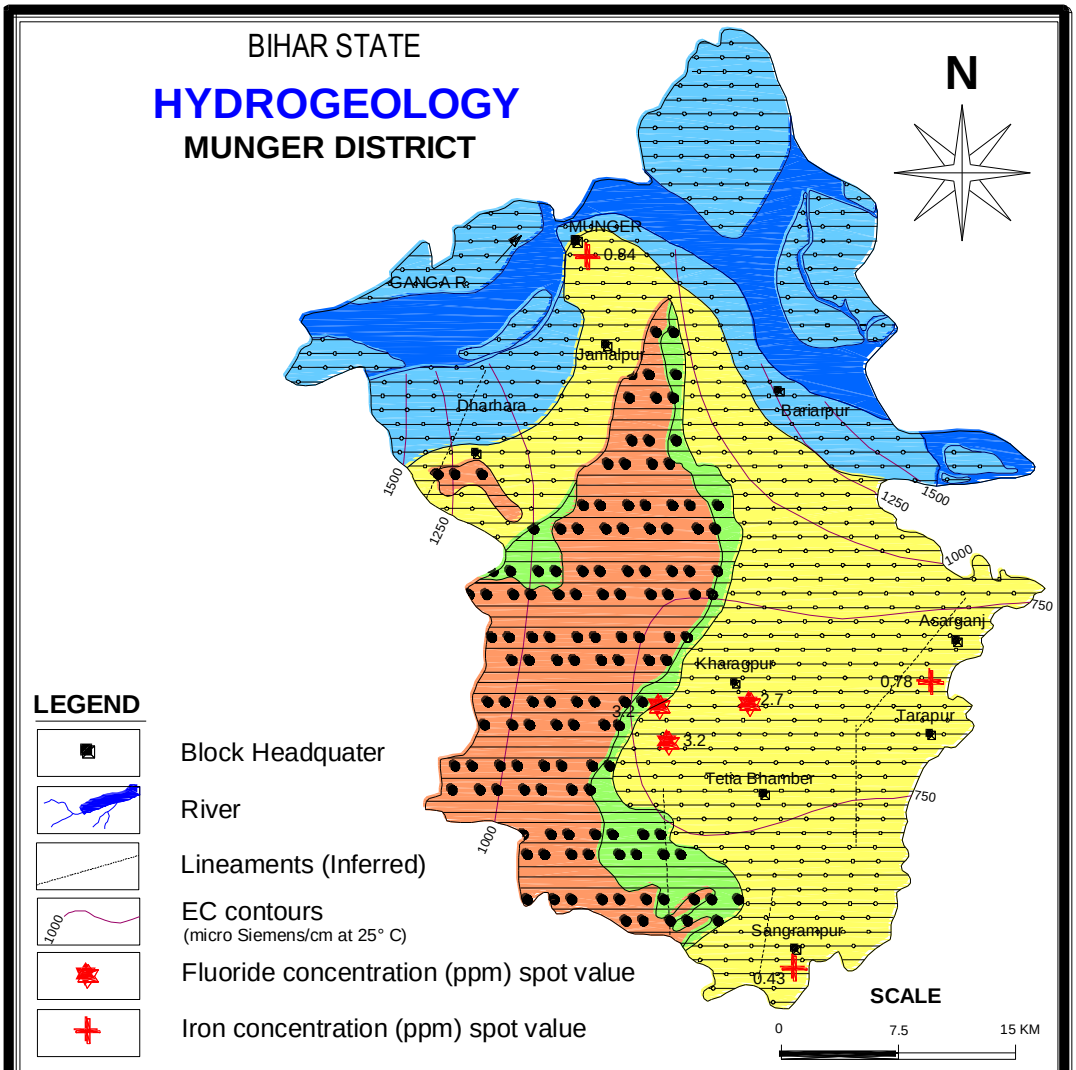


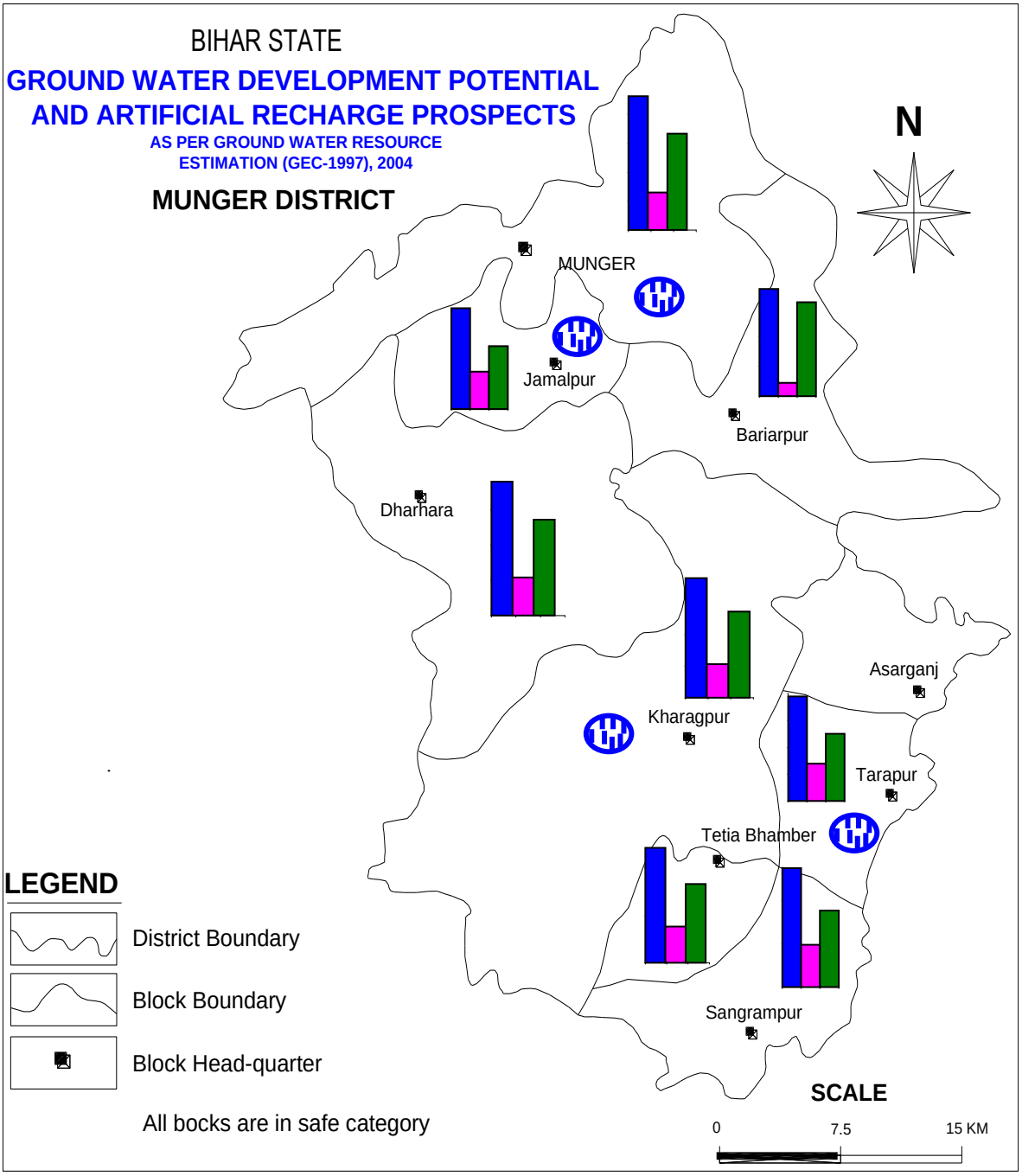
Fig. 4 Block wise stage of ground water development

Figure: - 5



FORMATIONS	AGE GROUP	LITOLOGY	LANDFORM	SYMBOL	GROUND WATER POTENTIAL
Unconsolidated Formation	Quarternary	Alluvium	Recent Alluvium		Yield ranging from 10 to 150 m^3/ hr.
			Older Alluvium		Yield ranging from 10 to 100 m^3/hr.
Consolidated Formation	Precambrian	Quartzite, Phyllite & Schist (Kharagpur Formation)	Pediplain		Moderate to limited yield prospect 1 to 10 m^3/hr.
			Hill (slope >20 %)		Very limited prospect along valley.

Figure:-6


BIHAR STATE
GROUND WATER DEVELOPMENT POTENTIAL
AND ARTIFICIAL RECHARGE PROSPECTS
AS PER GROUND WATER RESOURCE
ESTIMATION (GEC-1997), 2004
MUNGER DISTRICT
N
MUNGER
Jamalpur
Bariarpur
Dharhara
Kharagpur
Asarganj
Tarapur
Tetia Bhamber
Sangrampur
LEGEND
District Boundary
Block Boundary
Block Head-quarter
All bocks are in safe category
SCALE
0
7.5
15 KM

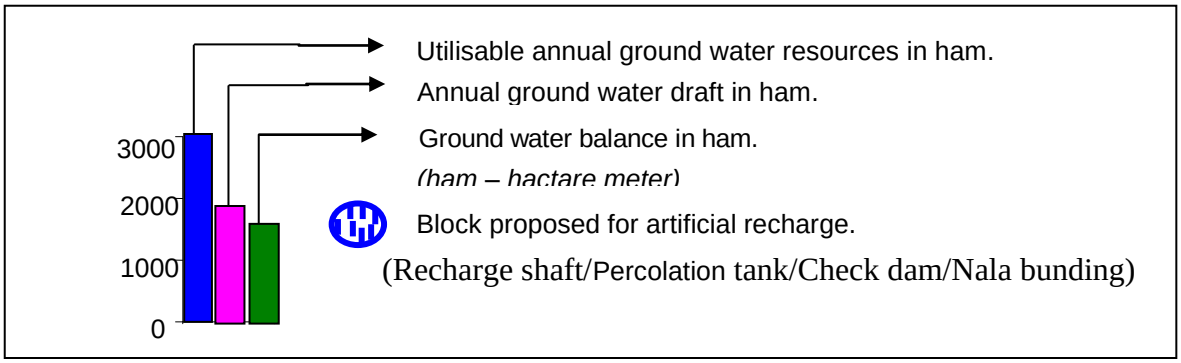

3000
2000
1000
0
Utilisable annual ground water resources in ham.
Annual ground water draft in ham.
Ground water balance in ham.
(ham – hactare meter)
Block proposed for artificial recharge.
(Recharge shaft/Percolation tank/Check dam/Nala bunding)

Table no. 1
Assessment of Dynamic Ground Water Resources of the Bihar state
Munger district(as on 31st March 2009)

(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 25	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	Asarganj	1824	532	123	655	176	1116	35.9
2	Bariarpur	4078	334	159	494	238	3505	12.1
3	Dharhara	6756	721	179	900	268	5766	13.3
4	jamalpur	2122	569	302	871	409	1144	41.1
5	Kharagpur	4585	1277	411	1688	575	2733	36.8
6	Munger	4635	797	491	1288	651	3186	27.8
7	Sangrampur	2381	901	135	1036	203	1278	43.5
8	Tarapur	2356	1049	146	1195	218	1089	50.7
9	Tetia Bhamber	2170	742	100	842	149	1279	38.8
	Total	**30907**	**6922**	**2046**	**8968**	**2888**	**21097**	**33.3**

Table no. 2

Block wise data on type wells, design and suitable pump of Munger District.

S.No	Block Name	Suitable Well type	Expected Discharge (LPM)	Recomm-ended depth (m)	Diameter of well	Suitable Drilling method	Type of pump	Success rate
1.	Asarganj	Tube well	100-500	50-80	6 inch	Rotary	Submersible	Good
2.	Bariarpur	Tube well	100-500	100-150	6 inch	Rotary	Submersible	Good
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor
3.	Dharhara	Dug well	60-100	10-15	2.5-3.5 m	Manual	Centrifugal	Moderate
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor
4.	Jamalpur	Dug well	60-100	10-15	2.5-3.5 m	Manual	Centrifugal	Moderate
		Tube well	100-500	100-150	6 inch	Rotary	Submersible	Good
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor
5.	Kharagpur	Dug well	60-100	10-15	2.5-3.5 m	Manual	Centrifugal	Moderate
		Tube well	100-200	40-70	4 inch	Rotary	Submersible	Good
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor

6.	Munger	Tube well	100-500	100-150	6 inch	Rotary	Submersible	Good
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor
7.	Sangrampur	Tube well	100-300	40-50	4 inch	Rotary	Submersible	Moderate
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor
8.	Tarapur	Tube well	100-500	70-100	6 inch	Rotary	Submersible	Good
9.	Tetia Bhamber	Tube well	100-300	20-40	4 inch	Rotary	Submersible	Good
		Bore well	100-300	100-150	4 inch	DTH	Submersible	Moderate to poor