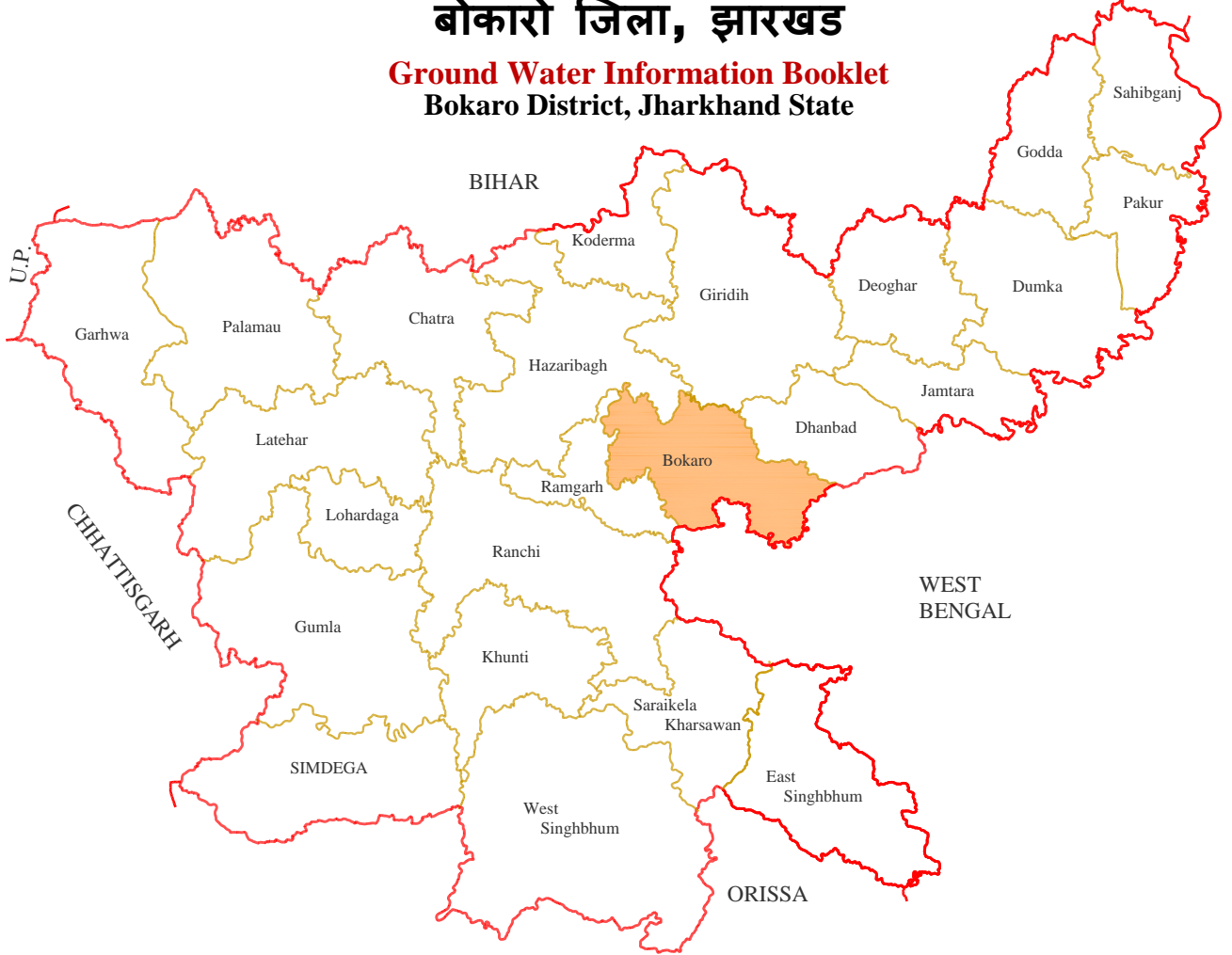




भूजल सूचना पुस्तिका

बोकारो जिला, झारखंड

Ground Water Information Booklet Bokaro District, Jharkhand State



केन्द्रीय भूमिजल बोर्ड

जल संसाधन मंत्रालय
(भारत सरकार)
राज्य एकक कार्यालय, राँची
मध्य-पूर्वी क्षेत्र
पटना

Central Ground water Board

Ministry of Water Resources
(Govt. of India)
State Unit Office, Ranchi
Mid-Eastern Region
Patna

सितंबर 2013
September 2013

भूजल सूचना पुस्तिका
बोकारो जिला, झारखंड
Ground Water Information Booklet
Bokaro District, Jharkhand State

Updated By

रोज़ अनीता कुजूर

(वैज्ञानिक स)

Rose Anita Kujur

(Scientist C)

राज्य एकक कार्यालय, राँची

मध्य-पूर्वी क्षेत्र, पटना

State Unit Office, Ranchi

Mid Eastern Region, Patna

BOKARO - DISTRICT AT A GLANCE

SI No.	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i) Geographical Area (Sq km.)	2, 861 Sq. km.
	(16) Administrative Divisions (As on 2012) Number of Block Number of Panchayat / Villages	8 251/744
	(ii) Population (As on 2011 Census)	20,61,918
	(iii) Average Annual Rainfall (mm)	1198 mm
2.	GEOMORPHOLOGY	
	Major Physiographic units	Hilly and undulating
	Major Drainages	Damodar, Konar and Bokaro
3.	LAND USE (Sq Km.)	
	a) Forest area:	722.3
	b) Net area sown:	158.10
	c) Cultivable area:	258.4
4.	MAJOR SOIL TYPES	Alfisols (Red gravelly and sandy soils) ultisols (red and yellow soils) Light textured Slightly Acidic Poor in N & P Fairly rich in K
5.	AREA UNDER PRINCIPAL CROPS (Sq. km.)(2011-12)	Rice-312.12 Pulses-75.65 Wheat-50.4
6.	IRRIGATION BY DIFFERENT SOURCES (Areas and Number of Structures)4th MI Census	No. of Structure
	Dugwell	5003
	Shallow Tube wells /Bore wells	27
	Surface flow schemes	1687
	Surfacelift schemes	285
	Net irrigated area	-
	Gross irrigated area(ha)	14543
7.	NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-03-13)	
	No of Dugwell	12
	No. of Piezometers	NIL
8.	PREDOMINANT GEOLOGICAL FORMATIONS	Gondwana Sandstone & shale, Granite Gneiss
9.	HYDROGEOLOGY	
	Major Water bearing formation (Pre-monsoon Depth to water level during 2012) Post-monsoon Depth to water level during 2012) Long term water level trend in 10 yrs (1992-2012) in m / yr.	Granite gneiss, Quarzite 5.30 – 12.65 mbgl 1.70 – 8.0 mbgl Rise: 0.091- 0.15 m/yr Fall: 0.02 – 0.17m/yr
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-12-12)	

	No. of wells drilled (EW, OW, PZ, SH, Total)	EW- 24 OW-2
	Depth Drilled (m)	26.2 – 200.85 m
	Discharge (litres per second)	Less than 1 to 415 m ³ /hr
	Storativity (S)	-
	Transmissivity (m ² /day)	-
11.	GROUND WATER QUALITY	Potable
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	EC 455 to 1421 micro mhos/cm at 25 ^o C.
	Type of Water	Alkaline
12.	DYNAMIC GROUND WATER RESOURCES (2009) in mcm.	
	Annual Replenishable Ground Water Resources	25408.41
	Net Annual Ground Water Draft	7956.10
	Projected Demand for Domestic and Industrial uses up to 2025	4121.09
	Stage of Ground Water Development	31 %
13.	AWARENESS AND TRAINING ACTIVITY	
	Mass Awareness Programmes Organized Date Place No. of Participants	NIL
	Water Management Training Programmes Organized Date Place No. of Participants	NIL
14.	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	NIL
	Projects completed by CGWB (No & Amount spent)	NIL
	Projects under technical guidance of CGWB (Numbers)	NIL
15.	GROUND WATER CONTROL AND REGULATION	NIL
	Number Of OE Blocks	NIL
	No. of Critical Block	NIL
	No. of Semi -Critical Block	1 (Chas)
	No. of Blocks notified	NIL
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Fluoride, Iron, Mn, Zn, above desirable limit around Industrial area.

**GROUND WATER INFORMATION BOOKLET OF BOKARO DISTRICT,
JHARKHAND STATE**

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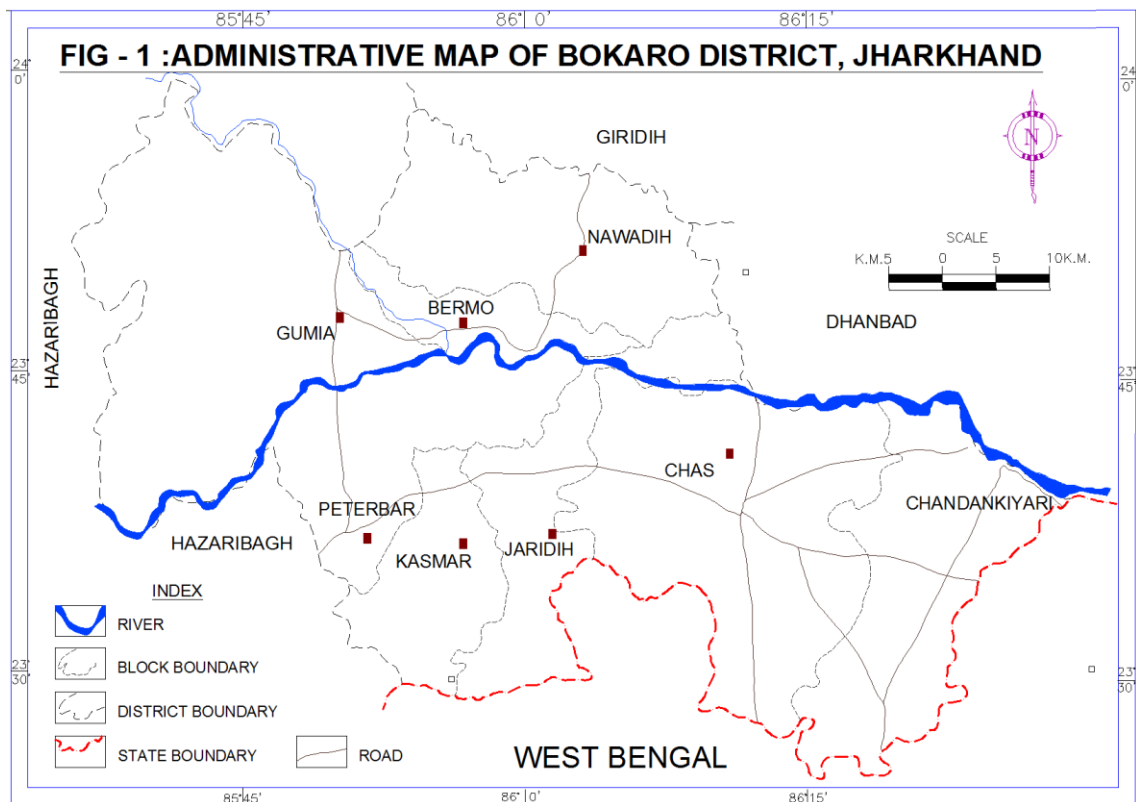
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GROUND WATER INFORMATION BOOKLET OF BOKARO DISTRICT,
JHARKHAND

1.0 INTRODUCTION :- Bokaro district is newly created district carved out from Giridih and Dhanbad district. It is one of the highly industrialized coal belt district in Jharkhand. Bokaro district is bounded by Giridih in North, Purulia (West Bengal) in the South, Dhanbad in the east and Hazaribagh in the West. The district is spread over 2861 Sq.Km lying between latitude 23⁰24'27" to 23⁰57'24" and East Longitude 85⁰34'30" to 86⁰29'10". It falls under survey of India toposheet No. 73 E/9, E/10, E/13, E/14, 73 I/1, I/2, I/5 and I/6.

1.1 Administration :- The district headquarter is at Chas(Fig-1). The district comprises of two sub divisions i.e. Chas and Bermo with eight blocks, 251 Gram Panchayat and 744 villages. Ninth block Chandrapura was carved out from Bermo block. According to 2011 census the total population of district is 20,62,330 and population density 720/km².



Its population growth rate over the decade 2001-2011 was 15.99%. (Fig 1 A)Bokaro has a sex ratio of 916 females for every 1000 males, and a literacy rate of 73.48%.It has 8 developed blocks namely (1) Chas, (2) Gomia, (3) Nawadih (4) Bermo, (5) Peterwar, (6) Kasmar, (7) Jaridih and (8) Chandankiyari. Table-1

TABLE-1: Administrative Division of Bokaro District

Block	Area (Sq. km)	Rural Population	Urban Population	Total Population	Male Population	Female Population
Chas	573.61	249083	564319	813402	427453	385949
Bermo	165.71	4222	185555	189777	99086	90691
Gomia	670.55	130898	100287	231185	118918	112267
Peterwar	305.71	127617	4533	132150	68127	64023
Kasmar	195.28	89974	0	89974	45947	44027
Nawadih	371.77	133848	4606	138454	70344	68110
Jaridih	207.53	75671	29317	104988	54445	50543
Chandankiyari	370.67	218597	11641	230238	119606	110632
Chandrapura (Newly created block)	NA	48776	83386	132162	68881	63281
	2860.83	1078686	983644	2062330	1072807	989523

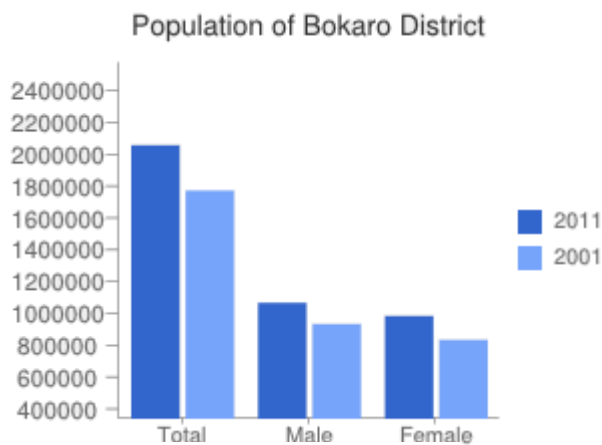


Fig 1A- Population comparison between 2001 & 2011 census

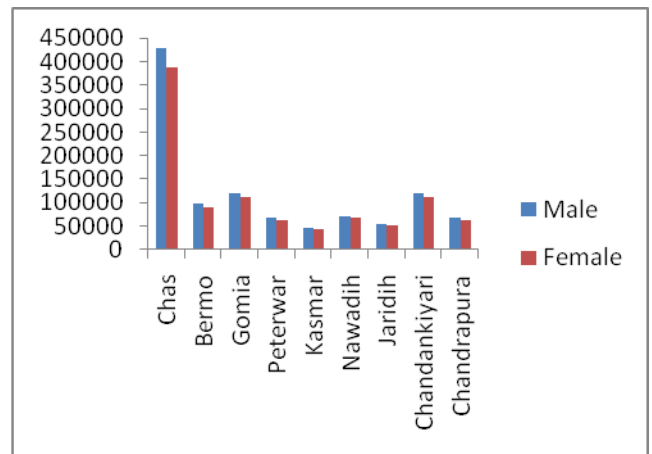
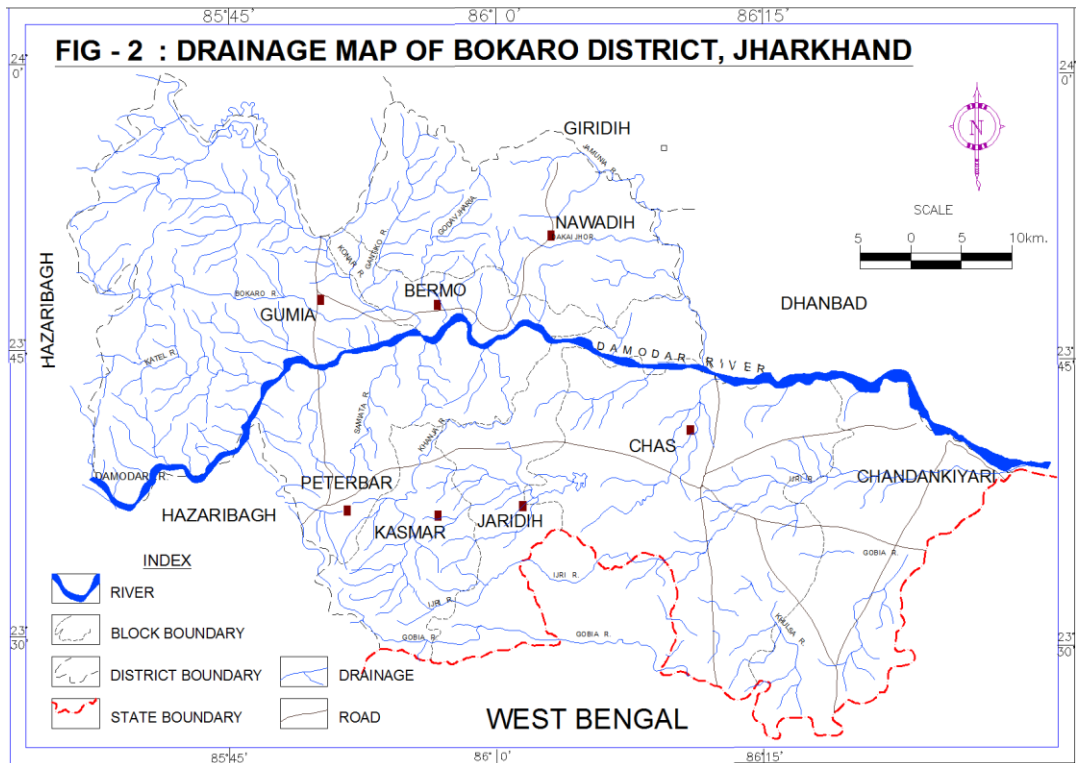


Fig 1B- Male & Female Population (2011 census)

1.2 Basin/Sub basin: Damodar basin is the main basin of the district. The sub basin like Ijri, Gobai, Konar, Bokaro etc. are mainly confined in the area.

1.3 Drainage :- The Damodar river is the most important river in the district which flows from West to East in the Central part of the district. The major tributaries of Damodar are Konar and Jamuniya. The minor tributaries of the Damodar river are Isri, Gobai, Tasharkhan, Kadwa, Khanju etc. The drainage system is mainly confined to weak zones viz. joints, fractures and faults. Drainage map is presented in Fig-2.



1.4 Land Use :- A large area about 25% of the district are under forest. The Cultivable land are divided into two categories - Low lands and uplands. Blockwise statistical data reveals that only 29% of the total geographical area is cultivable. The highest percentage of cultivable area is found in ChandanKiyari and Lowest being in Gomia block. The gross irrigated area is 14543 ha.

1.5 Studies / Activities carried out by Central Ground Water Board :- Central Ground Water Board has established 12 no. of network Hydrograph stations for monitoring of ground water behaviour and quality of Ground water in the district. The exploration by drilling have carried out to know the sub surface potential fractures, sub surface geology, depth, thickness of water bearing formation with their yield. The exploratory wells have been constructed at Chandan Kiyari and Chas blocks.

2.0 RAINFALL AND CLIMATE :

2.1 Rainfall :- An average rainfall of the district is 1363.57mm. Each block has a rain gauge station. The maximum rainfall is 1669.58mm in Chandan Kiyari Block and minimum in Bermo block 1093.70mm. The normal rain fall of the district is 1185mm. The maximum rainfall occurs during the monsoon month viz middle June to middle of October.

2.2 Climate :- The climate of Bokaro district is humid and sub tropical. It is characterized by hot and dry summer from March, to October and Cold winter from November to February. Humidity is high from July to September. The mean annual humidity is nearly 60%. In Summer the temperature rises 42 – 46⁰ C.

3.0 GEOMORPHOLOGY AND SOIL TYPES :-

3.1. Geomorphology :- The Bokaro district is part of Chhotanagpur Plateau. It is highly undulating and hilly all over the district. The regional slope of the district is towards east and controlled by the alignment of the tributaries of Damodar river. The hill ranges trending WNW – ESE. The average elevation of the undulating pediplain ranges from 200 – 350m above MSL. The highest hill prominent block is Gomia. The northern and western part of the district are having hilly ranges. Chas and Chandankiyari are low upland where cultivation is practiced.

3.2 Soil Types :- The soils of Bokaro district can be broadly grouped into the soil developed in different formation like Granite or Granite Gneiss of Archean Age, Sand Stone and shales of Gondwana Foundation and Alluvial Plain.

Texturally the soils of Bokaro district have been classified into four classes as :-

- a) **Stony and Gravelly :** These are low grade soils having a large admixture of cobbles, pebbles and gravels generally found at the base of the hills.
- b) **Sandy Soils :** It is found near the stream beds containing 60% sand and are easily drained. These are poor in respect of fertility and requires heavy manuring.
- c) **Loamy Soils :** These consists mostly of detritus of decomposed rocks and vegetables matter. It is suitable for cultivation. Normally these are found in valleys near the hills.
- d) **Clayey Soils :** These soils are found near tank beds. It is sticky soils. Their water bearing capacity is very high. The area is very fertile but yielding capacity improved with addition of sand, lime and organic manures etc.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology:- Ground water in the district is mainly replenished by the atmospheric precipitation. In fluent seepages from canal, streams and other surface water bodies, also contributes to the Ground water in the district. The hydrogeological condition of the district is very complicated due to wide variability of geology, topography, drainage and mining activity.

Hydrogeological map is presented in Fig-3. The district of Bokaro can be sub divided broadly into two hydrogeological units :-

- a) Fissured Formation
- b) Porus Formation or Unconsolidated Formation

Based on the degree of consolidation the fissured formation can be further sub divided into two namely :-

(i) **Consolidated Formation :** Ground water occurs in the area under confined to semi confined conditions. The fractured linaments are found to be an effective factor in facilitating Ground Water movement and storage.

(ii) **Semi Consolidated Formation :** Ground water occur in this formation under confined to Semi Confined condition. These are found in the Central part of the district.

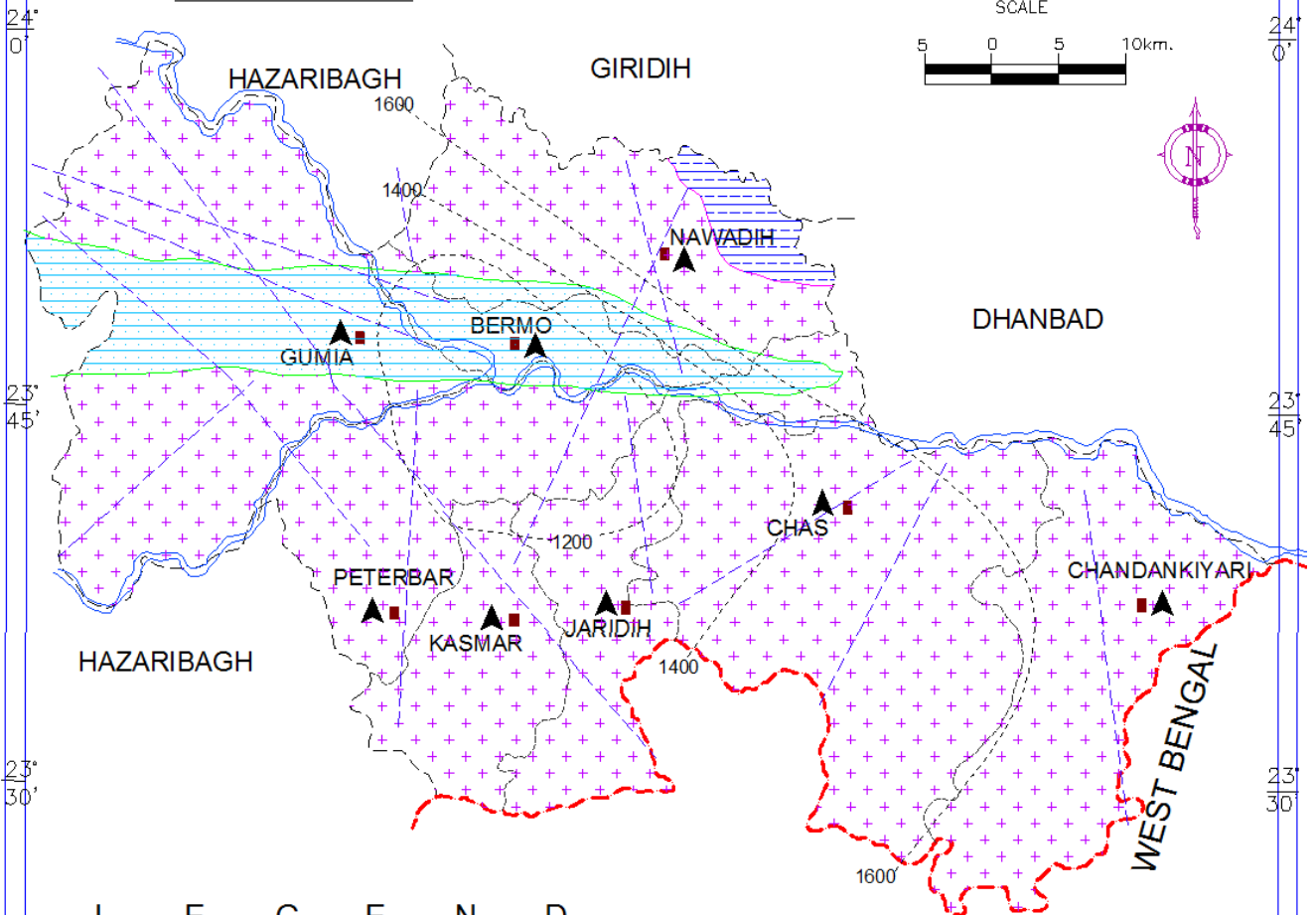
Unconsolidated Formation : It occupies the low laying area covered with recent alluvium deposited mainly by Damodar, Konar and Jamunia rivers. The ground water occurs in these areas under water table condition.

4.1.1 Exploratory Wells :- 19 exploratory wells were drilled by CGWB and 5 EWs through outsourcing in the district (Table -2) the available data reveals that 1 – 2 nos of fractures zones up to the depth of 150.00 mbgl. The static water level in the borewells varies from 1.25 to 19.07 mbgl. The discharge varies from meager to 415 lps.

TABLE-2: Exploratory Wells drilled by CGWB of Bokaro district as on 31.12.12

Location	Depth (m bgl)	SWL (m bgl)	Fracture (m bgl)	Discharge (lpm)
SDO compound	200.85	19.07	80.95, 111.45	135
Mahila Polytechnic-1	200.00	4.98	21, 25, 149	108
Mahila Polytechnic-2	190.90	4.50	17.5-19.00, 105 – 106.50	108
Khutri	191.00	1.25	not encountered	meagre
Azadnagar-1	136.00	3.91	62.80	25
Azadnagar-2	50.45	-	-	meagre
Azadnagar-3	193.1	4.12	-	108
Azadnagar-4	26.2	-	-	meagre
Chandankiary-1	200.00	16.9	108.5, 139.00	150
Chandankiary-2	-	17.02	147.95-148.5	43.86
HS Baramasia-1	172.35	2.1	147.95-150	415
HS Baramasia-2	154.05	2.3	144-145.5	415
HS Baramasia-3	43.35	2.26	not encountered	72
Chandra Inter Collage-1	55.90	2.45	30.00-30.50	72.6
Chandra Inter Collage-2	123.00	2.43	96.00-98.00	72.6
Mamarkudar,EW1	153.5	-	not encountered	Low discharge
Mamarkudar,EW2	199.05	-	not encountered	Low discharge
Idgadih,EW	184	-	not encountered	Low discharge
Pindrajora,EW	180	-	not encountered	Low discharge

**FIG - 3 : HYDROGEOLOGICAL MAP OF BOKARO DISTRICT
JHARKHAND**

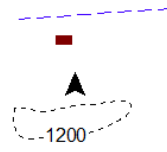


L E G E N D

AGE GROUP	LITHOLOGY	HYDROGEOLOGICAL CONDITIONS	GROUND WATER POTENTIAL
RECENT	FINE TO COARSE GRAINED SAND, SILT, CLAY, RECENT STREAM SEDIMENTS	<p>POROUS / UNCONSOLIDATED FORMATION</p> <p>Moderately thin restricted unconfined aquifers down to 50 m.</p>	LIMITED YIELD PROSPECTS BELOW 10 Cu.m/ hr.
GONDWANAS	SANDSTONE, SHALES, COAL SEAMS	<p>FISSURED / SEMICONSOLIDATED FORMATION</p> <p>Moderately thick regionally extensive confined / unconfined aquifers.</p>	LIMITED YIELD PROSPECTS BELOW 30 Cu.m/ hr.
PRE CAMBIANS	GRANITE -GNEISS, MICASCHIST, AMPHIBOLITE, PHYLITES etc.	<p>FISSURED / CONSOLIDATED FORMATION</p> <p>Groundwater restricted to weathered residuum and fracture zone down to 125 m</p>	LIMITED YIELD PROSPECTS BELOW 30 Cu.m/ hr.

HYDROGEOLOGICAL FEATURES

- LINEAMENT
- BLOCK H.Q.
- RAIN GAUGE STATION
- ISOHYETAL CONTOUR (mm)

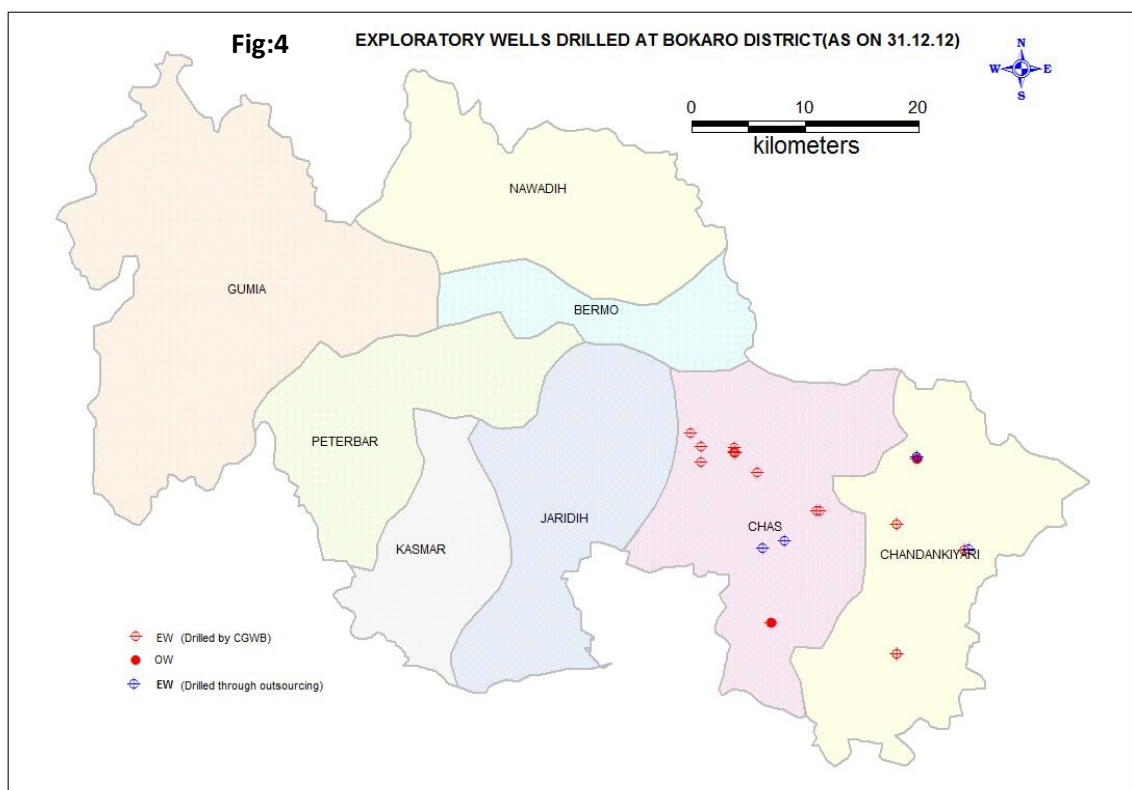


- RIVER
- BLOCK BOUNDARY
- DISTRICT BOUNDARY
- STATE BOUNDARY

85°45' 86° 0' 86°15'

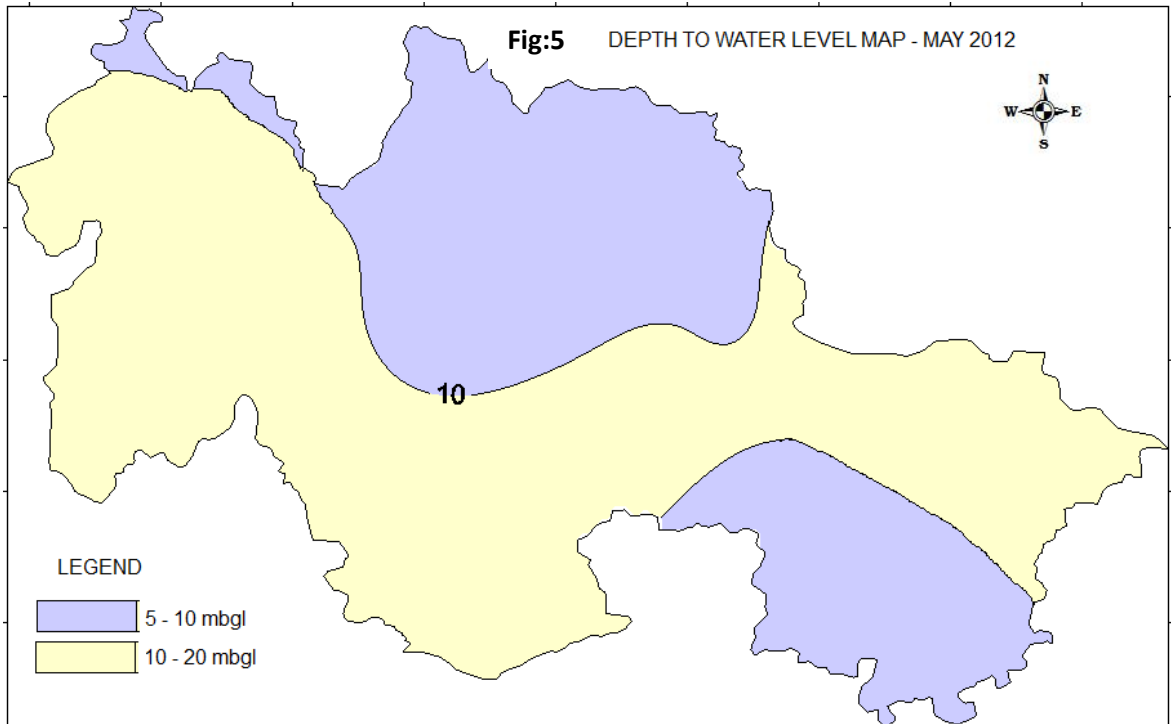
TABLE 3-Exploratory Wells Drilled Through Outsourcing (Accelerated Drilling Programme) during AAP (2004-05)

Location	Depth (m bgl)	SWL (m bgl)	Fracture (m bgl)	Discharge (lpm)
Paddudih	150	6.30	33.48 – 39.06	Low
Galudih	150	5.89	91.11 – 96.73	Low
Naudiha	150	4.01	28.10 – 33.72 39.34 – 44.96	2.11
ChandanKiyari	150	4.33	15.50 – 18.50 74.25 – 79.87	2.11
Nailanchal Ashram	150	3.18	90.92 – 96.54	< 1



4.1.2 Depth to Water Level :- CGWB has established 12 no. of network of observation wells for monitoring of ground water level to know the behaviour of ground water regime in the district. These wells are monitored every year in January, May, August and November. It has been shown in Table 4.

During Pre – Monsoon season in the district the minimum and maximum water level were observed as 5.3mbgl (Pindrajoria) and 15.0 mbgl (Mahuda) respectively. The water level in northern part of the district shows more than 10 mbgl. The water level in Chas area is more than 10 mbgl. Water level varies from 5 to 8 mbgl in the central and eastern part of the district.



The water level during the Post Monsoon season of the district ranges 1.70 to 8.0 mbgl. The water level in northern, western and eastern part is within 5.0 mbgl. The water level in Chas area is 8 mbgl. Water level in the central and southern part of the district varies between 5 to 10 mbgl. Pre & Post monsoon water level map is presented in Fig-4 & Fig-5 respectively.

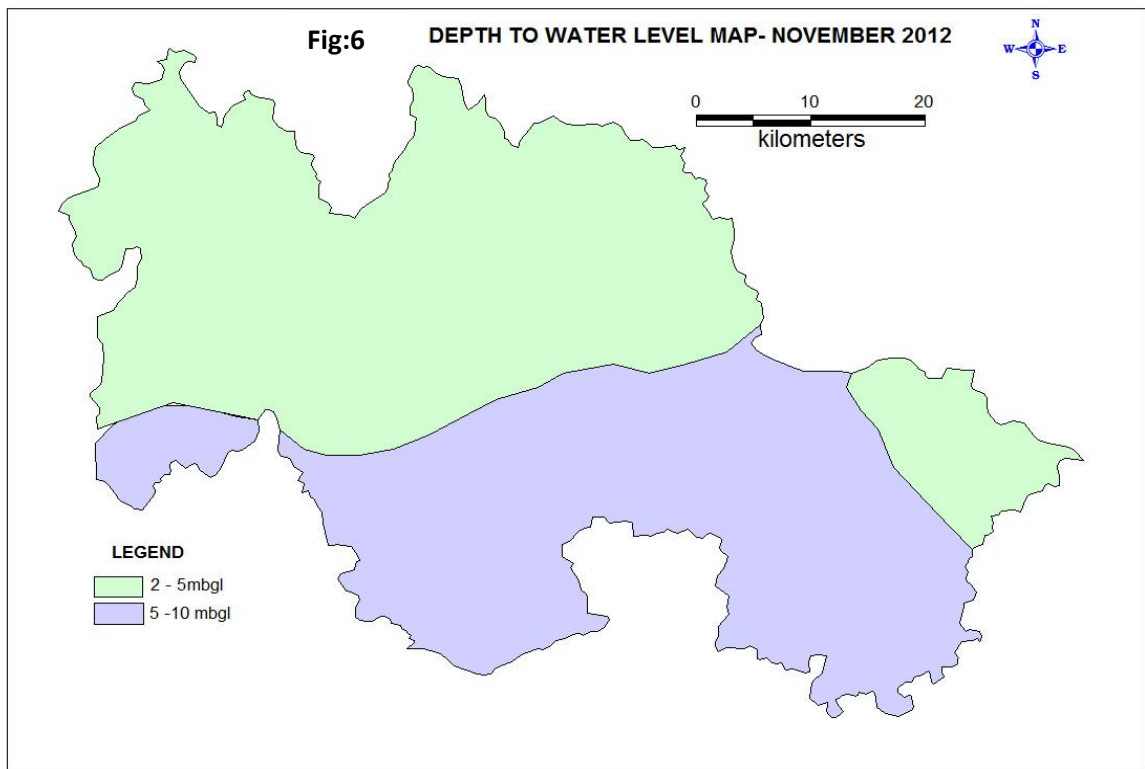


TABLE-4
Pre and Post Monsoon Water Level Data of Bokaro district in 2012

Location	Pre Monsoon (in mbgl)	Post Monsoon (in mbgl)
Chas	12.65	8.00
Pindrajora	5.3	1.75
Chandrapura	5.14	1.70
Gomia	10.60	3.11
Petarbar	10.40	6.00
Jaina more	12.00	6.82
Tenughat	6.50	3.09
Nawadih	6.12	3.99

4.1.3 Water Level Trend :- Rainy season is only recharge period in the Bokaro district. The maximum observations wells show rising trend in the district. These are the localized rising patches in the area. The pre and post monsoon observations at Jaina More, Chas is showing falling trend $> 0.2\text{m/yr}$. The trend of Ground Water Level is tabulated in Table 5.

TABLE-5: Trend of Ground Water Level
Period - 2002 – 2011

Location	Premonsoon		Postmonsoon	
	Rise (Meter / Yr.)	Fall (Meter/Yr.)	Rise (Meter / Yr.)	Fall (Meter/Yr.)
	Chandrapura	0.2	-	0.028
Phusro/Bermo	0.483	-		
Pindarjora	0.283	-	-	0.127
Chas	-	0.261	-	0.446
Jaina More	-	0.262	-	0.432
Gomia	-	0.179	-	0.233
Tenughat	0.15	-	0.035	-
Nawadih	0.246	-	0.231	-
Petarbar	0.113	-	0.108	-

4.2 Ground Water Resources :- Ground Water Resources assessment has been carried out based on the recommendations of Central Water Estimation Committee Report 1997 (GEF, 1997). The assessment has been evaluated for all the blocks. All blocks of the districts falling under “Safe” Category except Chas which falls under semi critical category. The stage of Ground water development varies from 13.56% to 75.52 %.(Table – 6 & Fig 7)

4.3 Ground Water Quality :- To evaluate the quality of Ground Water samples have been collected from 5 NHNS in the district. These samples have been considered to assess

TABLE-6: Block wise Ground Water Resources of Bokaro District as on 31st March 2009

S.N.	Assessment Unit	Net Annual Ground water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground water Draft for Domestic and Industrial Water Suply	Existing Gross Ground Water Draft For all Uses	Allocation for Domestic and Industrial Requirement suply upto next 25 years	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development (12/9)*100 (%)
1.	Bermo	994.42	132.704	238.9	371.6	357.84	503.88	37.37
2.	Chandan Kyari	2827.75	235.248	315.5	550.8	472.62	2119.88	19.48
3.	Chas	5227.44	1631.424	1188.3	3947.68	1779.92	1816.09	75.52
4.	Gomia	7328.04	713.632	279.8	993.4	419.05	6195.36	13.56
5.	Jaridih	1481.31	401.824	142.9	544.7	213.01	866.48	36.77
6.	Kasmar	1595.20	606.68	128.5	735.2	192.48	796.05	46.09
7.	Nawadih	3495.12	608.768	266.5	875.3	399.22	2487.14	25.04
8.	Petarwar	2459.13	873.712	191.6	1065.3	286.96	1298.46	43.32
	TOTAL (ham)	25408.41	5203.99	2752.11	7956.10	4121.09	16083.33	31.31

TABLE-7: Chemical Analysis data of Ground Water of Bokaro District (May-2011)

S.N.	Location	Block	E.C.μ Siemen/cmat 25° C	pH	CO ₃	HCO ₃	Cl	Ca	Mg	TH as CaCO ₃	Na	K
1.	Chas	JARIDIH	810	7.91	0	191	99.26	30	41	240	58	6.18
2.	Gomia	GOMIA	1215	7.24	0	283	160	20	73	350	114	3.5
3.	Petarbar	PETARBAR	870	7.31	0	55	153	60	16	215	104	2.2
4.	Jaina More	CHAS	1421	8.00	0	80	163	90	47.4	420	48	0.5
5.	Tenughat	GOMIA	455	7.02	0	141	32	36	19	170	32	0.5

the chemical quality of ground water and its suitability for drinking and irrigation purposes. The analysed results are given in the Table – 7.

The results of the Ground Water samples were evaluated in accordance with the standard (ISI – 1993) for drinking purpose. The samples represent the quality of phreatic zone or shallow zone. The EC value varies from 455 – 1421 micro siemens / cm. The constituents are under permissible limit as per the Indian Standard of Drinking Water (BIS-10500 – 91). The P^H value of Ground Water indicates its alkaline nature. The total CaCO₃ value varies from 170 – 420 mg/l. Although all the constituents are within tolerance limit as per the drinking water norms.

4.4 Status of Ground Water Development There is sufficient scope for shallow as well as deep borewells in the district. Jharkhand State Government has constructed a number of borewells to minimize the scarcity of drinking water problem (Table-8). Central Ground Water Board has been drilled five borewells upto 150 mbgl in the district. The discharge of borewells ranges from less than 1 lps to 2.1 lps. The casing length varies from 6.07m to 19.40 mbgl. The static water level at Paddudih is maximum 6.30 mbgl.

TABLE-8
Govt of Jharkhand
Drinking Water & Sanitation Department
Status of T/Wells as on 1.04.2012

District	Division	No of T/wells as on 01.04.2012	Total Defunct T/Well	No of Running T/wells	% Running Tube Well
Bokaro	Chas	10845	1541	9304	85.79
	Tenughat	7457	1060	6397	85.79

5.0 GROUND WATER MANAGEMENT STUDY

5.1 Ground Water Development :- The shallow and medium dugwells are suitable for extraction structures in the district. It is necessary for drinking as well as irrigation purpose. The stage of ground water development in the district is 31.31% only. Thus there is sufficient scope for development through dugwell, shallow and medium borewells. Construction of dug cum borewells structure is also suitable for enhance the yield of dug well in respect of cost beneficial and economical. The Ground Water development varies in different places depending on the availability of favourable locations.

Potential availability for the Ground Water Development considering the Ground Water draft has been worked out as per norms of Ground Water Estimation Committee 1997

(GEC – 1997). The details of Ground Water recharge, estimation of annual Ground water availability, annual draft net Ground water balance and stage of Ground water development has been evaluated. The total ground water draft for irrigation in the district is 5203.99 ham. The net annual ground water availability and the existing ground water draft for all uses is 25408.41ham and 7956.10ham respectively.

5.2 Water Conservation and Artificial Recharge :- The total irrigation potential created is 10039 hectare and potential utilized 6526 hectare only as per 4th MI census. During rainy season most of the rain water goes as runoff. At many places shortage of water observed in the district. Construction of water conservation structures will help to arrest run off, recharge the aquifer and retain the soil moisture. Contour bunding, check dam, gully plug and percolation tanks are suitable structures in the hard rock areas. In mines area, water can be stored in the pond.

A master plan for artificial recharge has been prepared by CGWB. The identification of the area suitable for artificial recharge has been done on the basis of depth of mean post-monsoon water level. The areas where the average water level of last 10 years is more than 5 bgl in post-monsoon period (November) has been considered suitable for artificial recharge. The basin wise surface water availability with 60% dependability has been taken from the existing field condition. The surface water required at 60% efficiency for artificial recharge is 62.2743 MCM. Total volume of water required for artificial recharge up to the depth of 3 mbgl is 37.29 MCM. Total surplus runoff available after the recharging of the required volume of water is 37.9257 MCM. The distribution of surplus surface water resource generated within the district is given below.

TABLE-9 : Requirement of Surface Water Resources for Artificial Recharge to Ground Water

Name of District	Area identified for Artificial Recharge (sq.km.)	Volume of unsaturated zone available for recharge	Total Volume of water that can be recharged (MCM)	Surface Water required for recharge at 60% efficiency (MCM)	Total surface water available (MCM)	Total surplus runoff available (MCM)
Bokaro	339	1006.83	37.29	62.2743	100.2	37.9257

TABLE-10: Number of Structures for Artificial Recharge

District	Volume of water required at 60% efficiency (mcm)	Resource to be harnessed by				Estimated cost of structures in rupees (2011) (Lakhs)	
		Percolation tank		Nala Bund		Percolation tank @ Rs 27.75 lakhs	Nala Bund@ Rs 3.07 lakhs
		Vol MCM	Nos	Vol MCM	Nos		
Bokaro	62.2743	31.14	165	31.14	992	4578.750	3045.440

The volume of surface water considered for planning the artificial recharge is based on the surplus runoff availability and the space available for recharge. Based on the field situation it has been considered that 50% storage will be through percolation tanks and 50% through Nalabunding in hard rock areas. For the percolation tank single filling capacity is 94 TCM. Considering 100% of double filling, the gross storage is 188 TCM. For Nala Bunding single filling capacity of 12 TCM, the actual storage will be 30 TCM based on 250% of multiple filling.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS :

During Summer season the dug well dried away. The deeper ground water level has been observed in Bokaro District (Jharkhand). The ground water is contaminated with fluoride in two blocks. Iron is also found above desirable limit. Trace elements like Mn & Zn is found above permissible limit around industrial area.

7.0 AWARENESS AND TRAINING ACTIVITY

7.1 Mass Awareness Programs and Water Management Training Programs by Central Ground Water Board : NIL

7.2 Participation in exhibition fair : NIL

7.3 Presentation & Lectures delivered in Public Forum / Audio / T.V. / Institution of Repute / Grassroots Associations / NGO / Academic Institutions etc. : NIL

8.0 AREA NOTIFIED BY CENTRAL GROUND WATER BOARD / CENTRAL GROUND WATER AUTHORITY :-

As per the ground water resource assessment evaluated all blocks of the district falling under the safe category. Thus, the authority has not been notified any blocks.

9.0 RECOMMENDATIONS :-

1. The district's economy is primarily agriculture based and most important requirement is Ground Water Development for sustainable management of agriculture. The cropping pattern should be developed as per the availability of the water. Less water requirement farming practice is required.
2. Keeping in view, ground water balance is available in the district. So ground water development project with multidisciplinary approach should be taken up.

3. During implementation of any ground water development programme in the district, the economic aspect of the ground water development must be considered.
4. An integrated approach should be adopted for site selection for borewells construction in the district. Apart from hydrogeological survey, the aid of Geophysics and remote sensing should also be taken up for selecting the borewells.
5. The dugwells must be away from the active coal mines area, because of dewatering and seepage etc.
6. In Damodar sub basin of the district, conjunctive use management of surface and ground water should be taken up.
7. In Chas and Chandankiyari Block of the district, the chemical analysis of water samples should be carried out regularly so that suitable measure could be taken to minimize the bad effect of chemical constituents like Fe, Nitrate and Floride which are reported to be beyond permissible limit.
8. An artificial recharge structures like Check dam, Gully Plug and percolation tank etc. can be constructed for conservation of Ground Water at favourable site.

