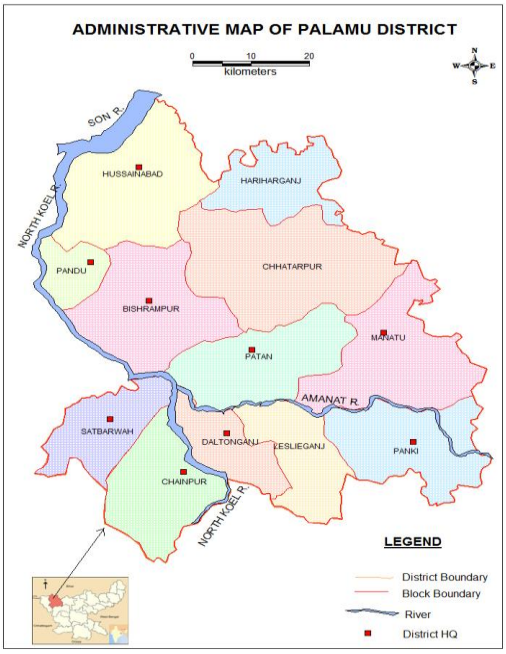
भूजल सूचना पुस्तिका

पलामू जिला, झारखंड

Ground Water Information Booklet

Palamu 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

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Palamu District, Jharkhand State

Prepared By

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State Unit Office, Ranchi
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GROUND WATER INFORMATION BOOKLET OF PALAMU DISTRICT, JHARKHAND STATE

CONTENTS

PALAMU DISTRICT AT A GLANCE

Sl. No.	ITEMS		Statistics		
1.	GENERAL INFORMATION				
	i)	Geographical area (SqKm)	5043.8		
	Administrative Division (As on 2011)				
	i)	Number of Tehsil/ Block	12		
	ii)	Number of Panchayat/Villages	283/1918		
	iii)	Population (As on 2011 Census)	1939869		
	iv)	Average Annual Rainfall (mm)	1335		
2.	GEOMORPHOLOGY				
	Major physiographic unit:		Hills, Plateau and narrow valleys		
	Major Drainages:		Koel, Auranga and Amanat		
3.	LAND USE (Sq. Km)				
	a)	Forest area:	1407.764		
	b)	Net area sown:	877.91		
	c)	Fallow Land:	849.53		
	d)	Area not suitable for culivation	486.93		
4.	MAJOR SOIL TYPE		Alfisols/Ultisols		
5.	AREA UNDER PRINCIPAL CROPS (2010-2011)		Area (HA)	Production (MT)	Productivity (KG/HA)
	a) Kharif		95921	198872	2073.289
	b)Rabi		38439	42533	1106.506
6.	IRRIGATION BY DIFFERENT SOURCES (Areas in Ha and Number of Structures) 4th MI census		Numbers		Area(Ha)
	Dugwell		77715		12783
	Tubewell / Borewell		228		
	Tank/ponds				
	Canals				8675
	Other sources		Malay River scheme, Jinjoi and Sonare irrigation schemes		11446
	Net irrigated area(ha)		34124		
	Gross irrigated area		67028		
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (As on 31-3-2012)		20		
	No of Dug wells		20		
	No of Piezometers		00		
9.	HYDROGEOLOGY				

	Major Water bearing formation	Chotanagpur Granite Gneiss, Vindhyan Limestone, Shale, Recent Alluvium, Gondwana Sandstone & Shale	
	(Pre-monsoon Depth to water level during 2012) m bgl.	3.15-13.5	
	(Post-monsoon Depth to water level during 2012) m bgl.	2.8 – 8.85	
	Long term water level trend in 10 yrs (2003 - 2012) in m/yr	Rise	0.798 - 1.189
		Fall	0.015 - 0.558
10.	GROUND WATER EXPLORATION BY CGWB (As on 31-07-2007)		
	No of wells drilled (EW, OW, PZ, SH, Total)	6 (EW), 8(OW)	
	Depth range (m)	80-200	
11.	GROUND WATER QUALITY		
	Presence of Chemical constituents more than permissible limit (e.g EC, F, As, Fe)	F and NO_3	
	Type of water	Potable	
12.	DYNAMIC GROUND WATER RESOURCES(2009)- in bcm		
	Annual Replenishable Ground water Resources	0.39	
	Net Annual Ground Water Draft	0.11	
	Projected Demand for Domestic and industrial Uses up to 2034	0.037	
	Stage of Ground Water Development	32.40%	
13.	AWARENESS AND TRAINING ACTIVITY	-	
	Mass Awareness Programmes organized	-	
	Date:	-	
	Place:	-	
	No of participant :	-	
	Water Management Training Programmes organized	01	
	Date	28/02/07	
	Place	Gandhi Smriti Town Hall, Daltonganj	
14.	EFFORT OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING		
	Project completed by CGWB(No & Amount spent)	-	
	Project under technical guidance of CGWB (Numbers)	-	
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	Fluoride and Nitrate concentration above permissible limit in patches

GROUND WATER INFORMATION BOOKLET
PALAMU DISTRICT

1.0 INTRODUCTION

1.1 **Administrative Details**

Palamu district spreading over an area of 5246.8 sq.km lies between North latitudes 23° 20´ 00´´ : 24° 40´ 00´´ and East longitudes 83° 20´ 00´´ : 85° 00´ 00´´ with it's headquarter at Daltonganj. The district is divided into 12 blocks namely i) Hussainabad ii)Hariharganj iii) Chhatarpur iv) Bishrampur v)Patan vi) Manatu vii) Panki viii) Lesliganj ix) Satbarwa x)Daltonganj xi) Chainpur xii)Pandu.(Plate – I) The district is bounded in the north by Rohtas and Aurangabad district of Bihar, in the south by Lohardaga and Gumla districts and east by Gaya(Bihar), Chatra and part of Ranchi district, in the west by Surguja district of Chattisgarh and Garhwa district . The total population of Palamu district as per the 2011 census is 19,39,869 persons with urban population of 2,26,003 persons and the rural population of 17,13,866 persons.

1.2 Drainage

The drainage of the district is mainly controlled by the river North Koel and its tributaries viz the Auranga and Amanat. The Koel, Auranga and Amanat have the upper reaches characterized by high bank and rocky beds while the lower reaches by sandy beds.(Plate-II). The general line of drain is from south to north towards river Sone.

1.3 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 20 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.

Plate – I

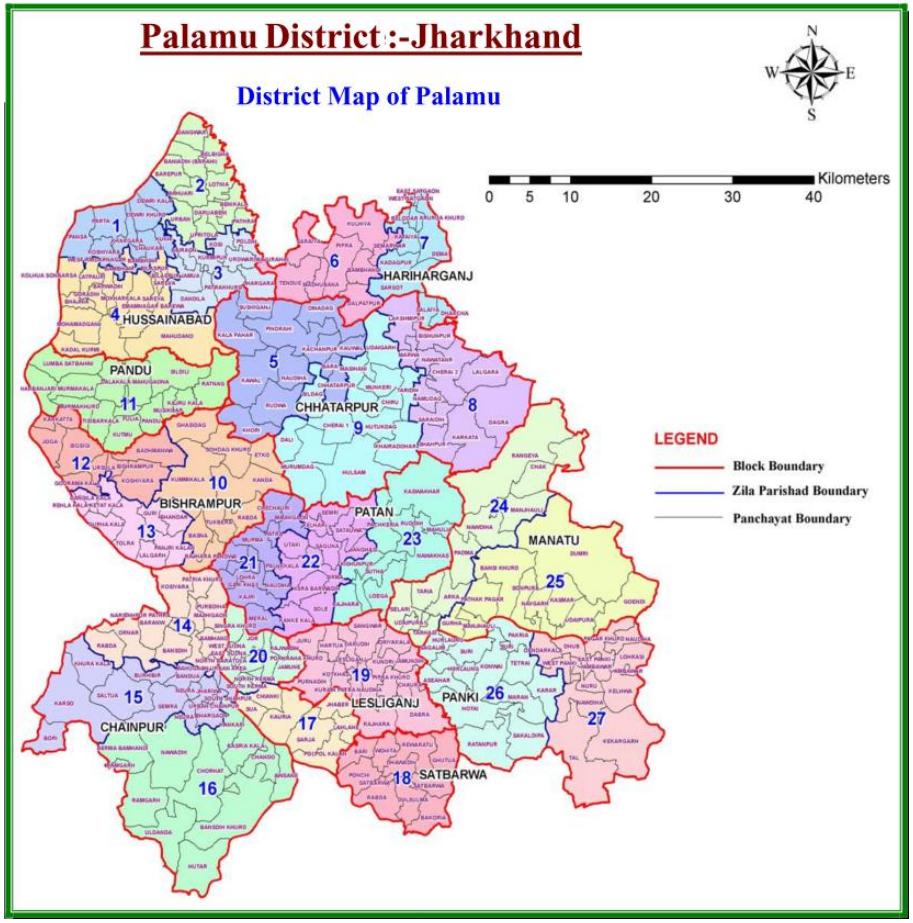
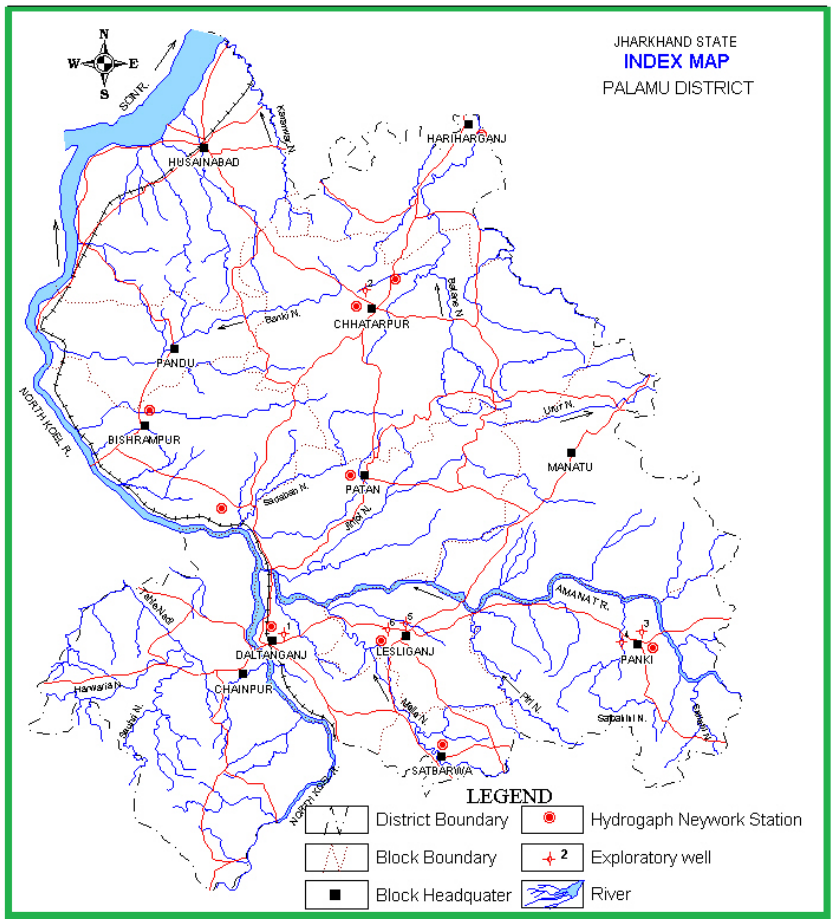


Plate-II



Source: Jharkhand Provisional Census Report 2011

2.0 HYDROMETEROLOGY

2.1 Rainfall

The district falls under unassured rainfall zone and hence receives monsoon rainsduring June to September. The average annual rainfall of the district is less than1200 mm as it comes under the rain shadow part. More than 80% of the precipitation is received during the monsoon months. Annual normal rainfall of the district is 1163.4 mm of which about 85 % is received between June and October.

2.2 Climate

The district is characterized by warm climate in March to June and later on there is a gradual decline in temperature from October onwards to December. January is the coolest month of the year. March, April and May are the hot and dry months of the district. The temperature varies from 5.6°C to 46.7°C. The district witnesses dust storms between March and June associated with low humidity, high temperature and fast blowing wind.

During winter season the district records temperature between 6 to 18 degrees centigrade and during summer the temperature increases upto 47 degrees centigrade.

3.0 GEOMORPHOLOGY AND SOIL TYPES

3.1 Geomorphology

The topography of Palamu district is characterized by highly rugged landscape with green forest all over the area. The elevation of the hill ranges in southern part of the district varies from 360-1110 m above msl. The master slope of the area in general tends towards north and east. In terms of the physoigraphy the district shows the following four broad categories of landforms

i) East-West trending hill ranges, consisting of crystalline and metamorphic rocks in the southern part

ii) Flat topped hills in the south-eastern

iii) The sub-plateau area lying south of the plains are separated by narrow valleys in parts of Bishrampur block.

iv) Narrow valleys along the course of the major rivers.

3.2 Soil

Three soil orders namely Entisols, Inceptisols and Alfisols were observed in Palamu district. Alfisols were the dominant soils covering 53.9 percent of total gross area followed by Entisols (21.5 %) and Inceptisols (20.0 %). Alfisols amongst which Red sandy soils are common and Ultisols of which red and yellow soils are common.

4.0 GROUND WATER SCENARIO

4.1 Hydrogeology

The district is covered by three major geological formations viz, the Precambrian crystallines, the Vindhyans and the Gondwanas. Besides, the tertiary laterite and alluvium also cover part of the district. The Alluvium cover of considerable thickness occurs in the northern part of the district along the Son and North Koel rivers. Ground water occurs mostly under phreatic condition in all the lithological units and locally under semiconfined and confined condition.(Plate-III)

4.1.1 Depth to Water level

During May 2012, the depth to water levels in Ground Water Monitoring wells tapping shallow aquifer ranged from 3.5 to 13.5 m bgl. Depth to ground water levels during the post monsoon (November 2012) varied between 2.8 and 8.85 m bgl. Categorization of depth to water level of pre-monsoon period (May 2012) for Ground Water Monitoring wells in Palamu district is presented in table-1

Table-1 Well Frequency for Different Ranges of Depth to Water Level- May – 2012

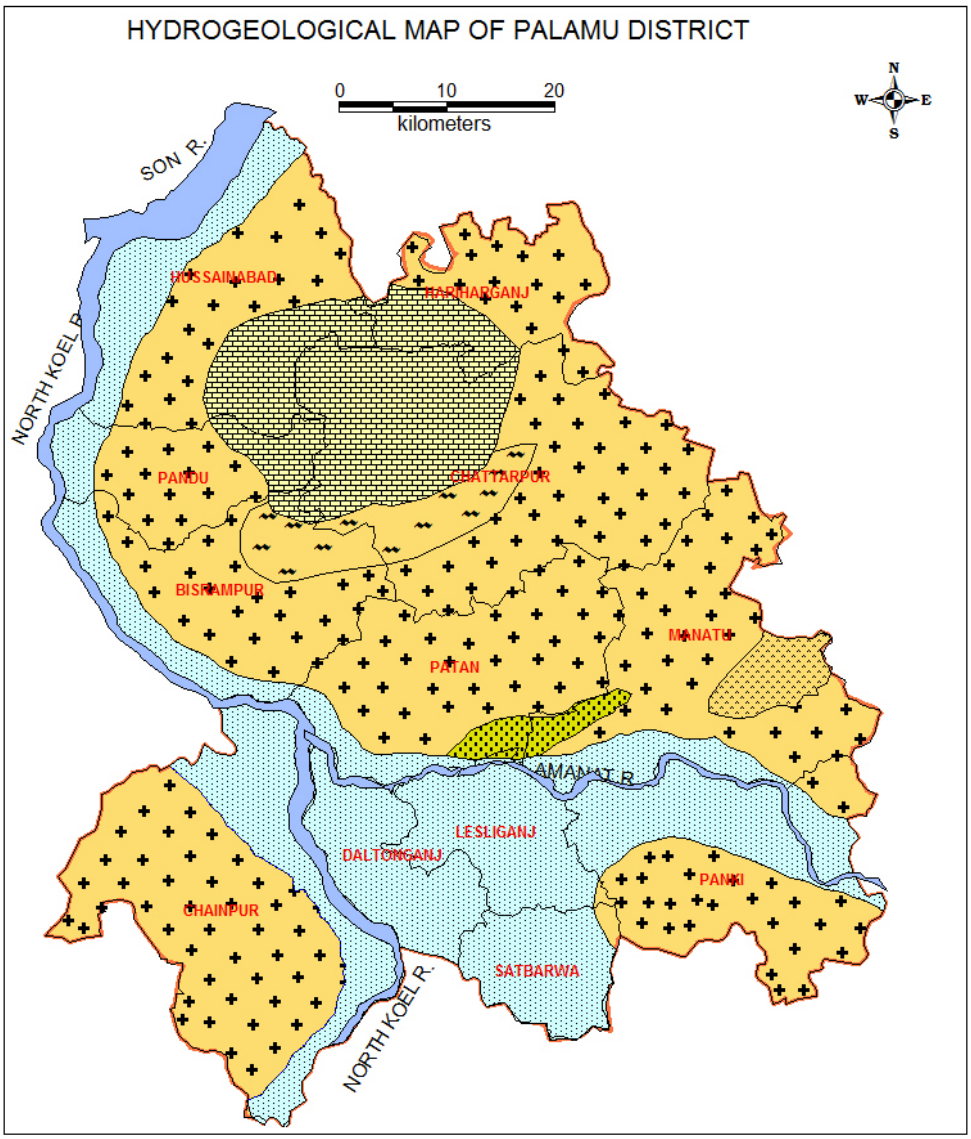
No. of Wells analysed	Depth to Water level (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of									
	Min	Max	0.0-2.0	%	2.0-5.0	%	5.0-10.0	%	10.0-20.0	%	20.0-40.0	%
16	3.5	13.5	0	0	2	7.1	10	64.3	4	28.6	0	0

Categorization of depth to water level of post-monsoon period (November 2012) for Ground Water Monitoring wells in Palamu district is presented in table-2

Table-2 Well Frequency for Different Ranges of Depth to Water Level- Nov – 2012

No. of Wells analysed	Depth to Water level (mbgl)		No. / Percentage of Wells Showing Depth to Water Table (mbgl) in the Range of									
	Min	Max	0.0-2.0	%	2.0-5.0	%	5.0-10.0	%	10.0-20.0	%	20.0-40.0	%
20	2.8	8.85	0	0	8	40	12	60	0	0	0	0

Plate-III



LITHOLOGY	AGE GROUP	HYDROGEOLOGICAL CONDITION	SYMBOL	GROUNDWATER POTENTIAL
Recent alluvium overlying weathered granite gneiss	Quaternary	Alteration of Sand, Silt & Clay. Ground water under unconfined conditions.		Moderate with a discharge of 10 - 15 LPS
Sandstone, Shale, Coal seams, Boulder beds	Gondvana Supper Group	Groundwater restricted to Weathered Zone Occurs under Semi - Consolidated conditions		Moderate with a discharge of 5 - 10 LPS
Limestone	Vindhyan Supper Group	Groundwater under semi Confined conditions within fractured joints and cavities		Moderate to High with a dischage of 10 - 15 LPS
Pegmatites, Dolomites	Archeians	Groundwater within Fractures zones and Weathered Residium		Poor to Moderate with a discharge of 5 LPS
Chhotanagpur granite gneiss complex	Archeians	Groundwater within Weathered mantle and within secondary porosity zone of the consolidated part.		Moderate to High with a dischage of 10 - 15 LPS
Older Metamorphies - Mica Schist Hornblends Schist, Graphite Schist	Archeians	Groundwater restricted to Weathered Unconsolidated Zone.		Poor to Moderate with a discharge of 5 LPS

The Depth to water level map (Plate-IV) has been prepared based on the analysed water level data of pre and post monsoon. In general during premonsoon, 2012 , depth to water level varies between 5 and 10 mbgl in 64.3% wells and > 10 mbgl in 28.6% wells,shallow water level also recorded in 2 wells out of 16 analysed wells. In general during postmonsoon, 2012 , depth to water level varies between 5 and 10 mbgl in 60% wells and 2 - 5 mbgl in 40% wells, which represents the water level within 10 mbgl.

4.1.2 Water Level Trend

Trend of Ground Water Level for the period 2003 to 2012 shows declining trend in 15 wells out of 17 in the range of 0.015 – 0.558 m/yr. The data is presented in table-3

Table-3 - **Trend of Ground Water Level**

Period	**01-Jan-03**	**to**	**01-Jan-12**		
Tahsil/Taluk	**Location**	**Well No**	**No of Data**	**Rise**	**Fall**
				(meter/yr.)	(meter/yr.)
Barwadih	Mandal	BPL13	5	1.189	-
Bishrampur	Bishrampur	BPL09	31	-	0.295
Bishrampur	Kajri	BPL27	29	-	0.086
Bishrampur	Rajhara	BPL08	31	-	0.032
Chhatarpur	Chhatarpur	BPL05	33	-	0.265
	Nawa	BPL33	9	0.798	-
Chhatarpur	Sandha	BPL29	17	-	0.050
Daltonganj	Daltonganj	BPL07	35	-	0.304
Hariharganj	Hariharganj	BPL19	29	-	0.234
Husainabad	Japla	BPL23	18	-	0.174
Lesliganj	Lesliganj	BPL26	23	-	0.251
Panki	Panki	BPL22	11	-	0.379
Patan	Kanda	BPL25	30	-	0.015
Patan	Nawadih	BPL18	24	-	0.558
Patan	Patan	BPL21	23	-	0.081
Satbarwah	Betla	BPL04	28	-	0.426
Satbarwah	Satbarwa	BPL24	34	-	0.026

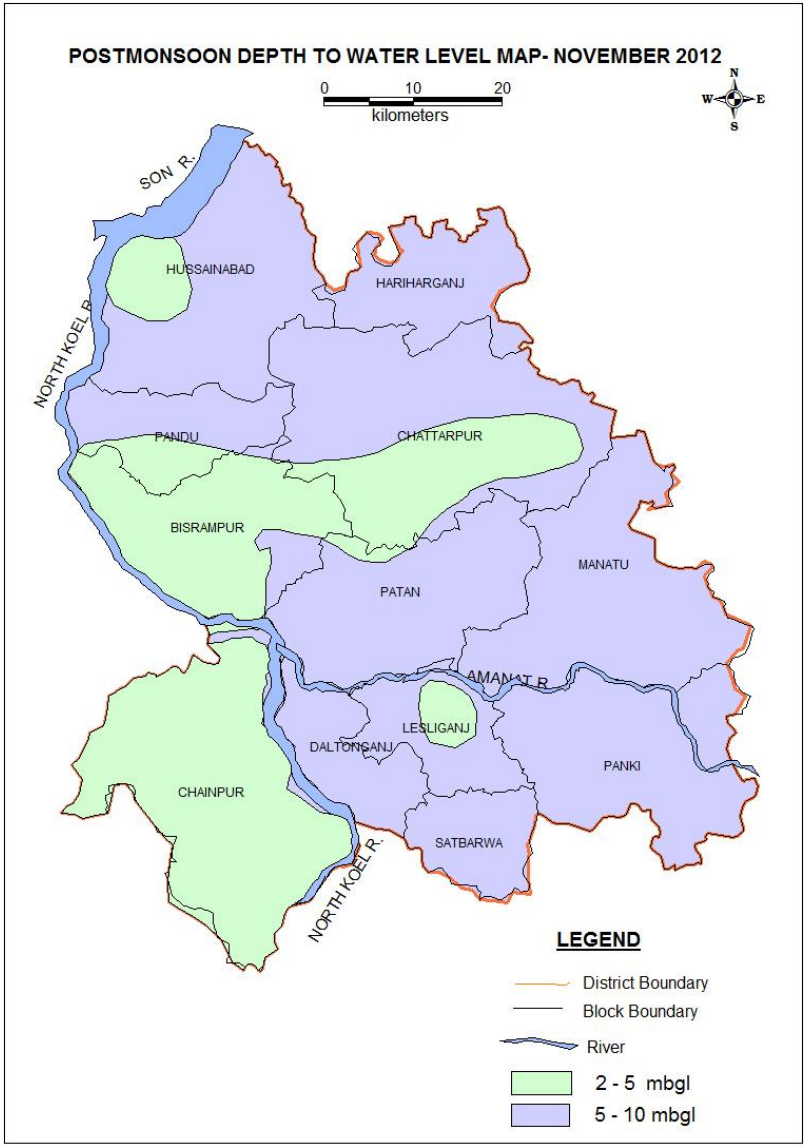


Fig IV: Pre & Post Monsoon Maps of Palamu District-2012

4.1.3 Aquifer Parameters

A total of 6 exploratory wells(Plate-V) and 8 observation wells have been constructed down to depth of 200 m in hard rock formation to decipher the potential fracture zones with their yields. The exploratory data reveals presence of potential fractures between 30 and 100 mbgl. The yield of the well in general as evident from the exploratory data has been found to vary between 1 and 62 m^3/hr. The piezometric level varies between 4 and 9.3 m bgl. Aquifers lying between the depth range of 30-100 m have moderate prospects of ground water development. The summarised hydrogeological data of exploratory drilling in the district has been given in table-4.

Table-4 Summarised hydrogeological data of exploratory drilling of Palamu district

Rock Type	Depth range (m bgl)	No.of fractures tapped	Depth zone within which fractures confined	Static Water level (m bgl)	Yield (m^3/hr)
Granite gneiss	76.8-199.3	1-5	11-183.9	4-9.30	0.9-61.30

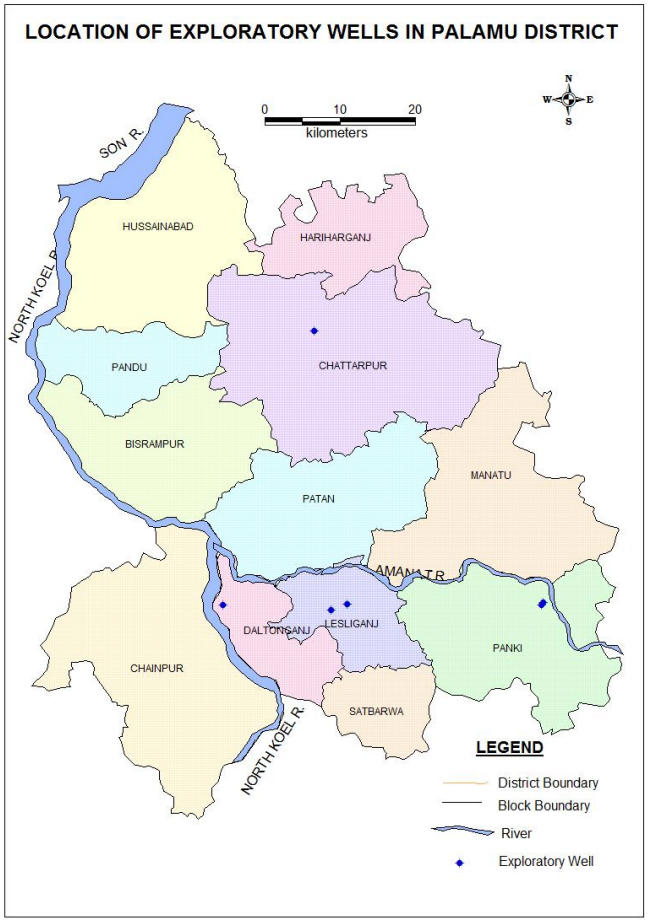


Plate-V: Location of Exploratory wells in Palamu district

4.2 Ground Water Quality

Ground water in the phreatic aquifers in Palamu district is alkaline in nature. The specific electrical conductance of ground water in phreatic zone during May 2011 was in the range of 439 -2380 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, Cl, F and NO_3. The chemical concentration of these constituents, when compared with the drinking water specification recommended by IS:10500,1991 as presented in table-4 below, indicates that in six samples pH exceeded the permissible limit of 8.5 .(Table-5)

Table-5 Number of samples exceeding permissible limit in the district.

Quality	IS:10500, 1991		No. of samples in the district exceeding permissible limit
	Desirable limit	Permissible limit	
pH	6.5-8.5	No relaxation	2
T.H	300	600	0
Ca	75	200	3
Cl	250	1000	0
Mg	30	100	0
Na	60	120	3
K	10	10	0

Table-6 Major chemical parameters of ground water samples of GWMS collected during May 2011

Block	Location	Well No.	E.C. micro	pH	CO3	HCO3	Cl	Ca	Mg	TH as	Na	K
			Siemens/cm							CaCO3		
			at 25o C		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Chhatarpur	Chhatarpur	BPL-5	1030	8.4	12	451	78	36	57	325	55	3.8
Daltonganj	Daltonganj	BPL-7	2380	8.39	6	586	277	46	84	460	225	4.1
Bishrampur	Rajhara	BPL-8	1040	8.44	12	348	114	32	72	375	47	3.2
Bishrampur	Bisarampur	BPL-9	1437	8.72	30	561	149	14	67	310	167	1.7
Patan	Nawadih1	BPL18	439	8.86	24	165	25	18	22	135	40	5.2
Hariharganj	Hariharganj	BPL19	1728	8.43	12	482	305	112	63	540	140	9.6
Satbarwa	Satbarwa	BPL-24	636	8.7	24	317	14	44	34	250	30	6.7
Patan	Kanda	BPL-25	612	8.81	36	287	7.1	20	33	185	53	1.6
Lesliganj	Lesliganj	BPL26	1263	8.32	6	226	216	80	40	365	90	2.6
Bishrampur	Kajri	BPL-27	480	8.6	24	226	7.1	16	40	205	17	0.6
Chhatarpur	Sandha	BPL29	460	8.51	18	207	18	14	25	140	41	4.1

4.3 Ground Water Resource

As per the latest resource estimation carried out following GEC 97 methodology, the overall stage of ground water development in Palamu district is 32% indicating sufficient scope of development. All blocks are under safe category. (Plate-VI).The ground water resource of Palamu district is shown in the table-7.

Table-7 : Dynamic Ground Water Resource of Palamu district as on 31st March 2009 as per GEC 97 (ham)

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Status of Ground Water Development

In the rural areas the entire water supply is dependent on ground water. Ground water

	Annual Replenishable Ground Water Resource					Natural Discharge during non-monsoon season
	Monsoon Season		Non-monsoon		Total	
Block	Recharge from rainfall	Recharge from other sources	Recharge from rainfall	Recharge from other sources		
	1	2	3	4	5	6
Bishrampur	4170.08	6.67	530.59	41.82	4749.16	474.92
Chainpur	3434.64	49.66	617.74	40.42	4142.46	414.25
Chhatapur	4469.71	92.10	580.57	35.66	5178.04	258.90
Daltonganj	2084.19	1.91	265.19	14.11	2365.41	236.54
Hariharganj	1175.35	2.66	209.73	16.32	1404.07	70.20
Husainabad	2252.57	115.23	390.97	25.60	2784.37	139.22
Lesliganj	1845.58	1.91	234.83	20.98	2103.30	210.33
Manatu	4601.50	5.33	561.98	23.92	5192.73	519.27
Pandu	1138.58	385.06	201.99	17.26	1742.88	87.14
Panki	4056.38	206.98	516.13	19.95	4799.44	479.94
Patan	2560.27	672.28	461.69	44.94	3739.19	373.92
Satbarwah	1051.83	1.74	200.75	16.78	1271.11	127.11
	32840.67	**1541.53**	**4772.16**	**317.78**	**39472.15**	**3391.75**

Unit : ham

Net Annual Ground Water Availability	Annual Ground Water Draft			Projected Demand for Domestic and Industrial uses upto 2034	Ground Water Availability for future irrigation	Stage of Ground Water Development (%)
	Irrigation	Domestic and Industrial uses	Total			
7	8	9	10	11	12	13
4274.25	1268.11	226.60	1494.71	339.41	2666.73	34.97
3728.22	1117.31	299.00	1416.31	447.85	2163.06	37.99
4919.14	866.75	281.66	1148.41	421.87	3630.51	23.35
2128.87	457.97	216.33	674.30	325.26	1345.64	31.67
1333.86	489.98	148.48	638.46	222.39	621.49	47.87
2645.15	583.25	366.49	949.74	549.41	1512.49	35.91
1892.97	763.28	134.45	897.73	201.38	928.31	47.42
4673.45	591.14	165.24	756.38	247.50	3834.81	16.18
1655.74	439.87	125.58	565.45	188.10	1027.77	34.15
4319.49	448.69	209.57	658.26	313.89	3556.91	15.24
3365.27	1563.68	247.67	1811.35	370.96	1430.63	53.82
1144.00	592.06	88.80	680.86	133.00	418.93	59.52
36080.40	**9182.10**	**2509.87**	**11691.97**	**3761.03**	**23137.27**	**32.40**

development is mainly carried out in the district through dug wells and Hand pumps. Dug wells are in general of 2 m diameter and between 8 to 15 m depth, depending on the thickness of the weathered zone, tapping the shallow

ground water in the weathered zone and uppermost slice of the basement. Large number of dug wells used for drinking water is under private ownership for which there is no reliable data. Over the years Mark II/ Mark III hand pumps are being drilled in large numbers for ground water development. These hand pumps have the following two major advantages i) are less susceptible to contamination from surface sources and ii) they tap fractures between 20-60m depth which have been found to be less affected by seasonal water level fluctuation and thus have lesser chances of failure even during extreme summer. In rural areas of Palamu district the number of hand pumps drilled by PHED is 20065 of which 17171 are under working condition as on April 2012. There are 7715 dug wells, 213 shallow tube wells and 15 tubewells as per minor irrigation census 2006-07. In the urban areas ground water plays a supplementary role in water supply, the major supply being made through dams, reservoirs or weirs across rivers or streams. No authentic data is available on the number of ground water structures catering the urban water supply.

Plate-VI

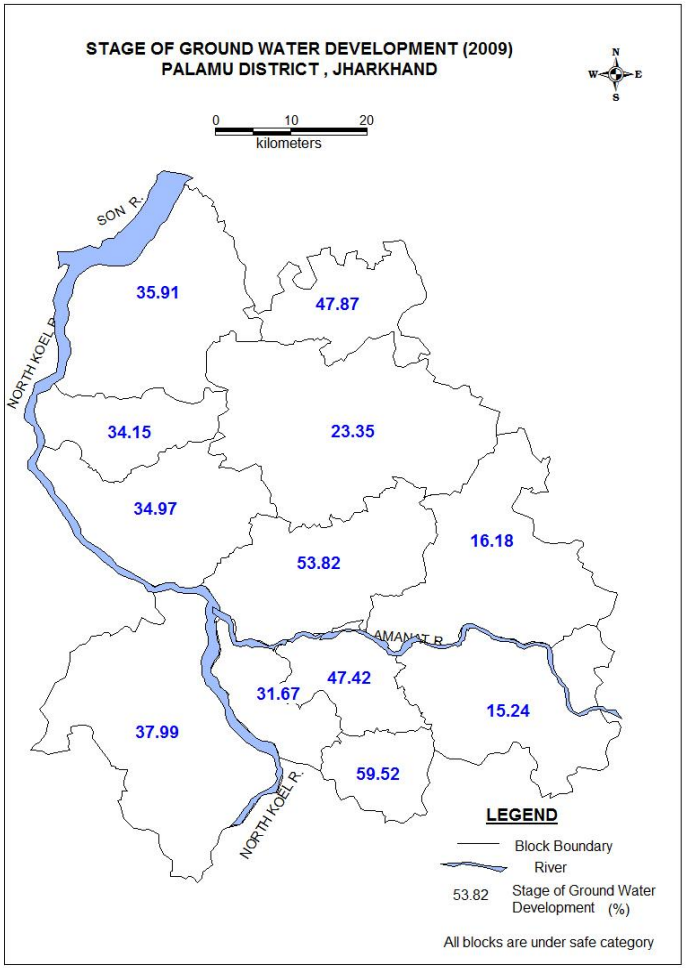
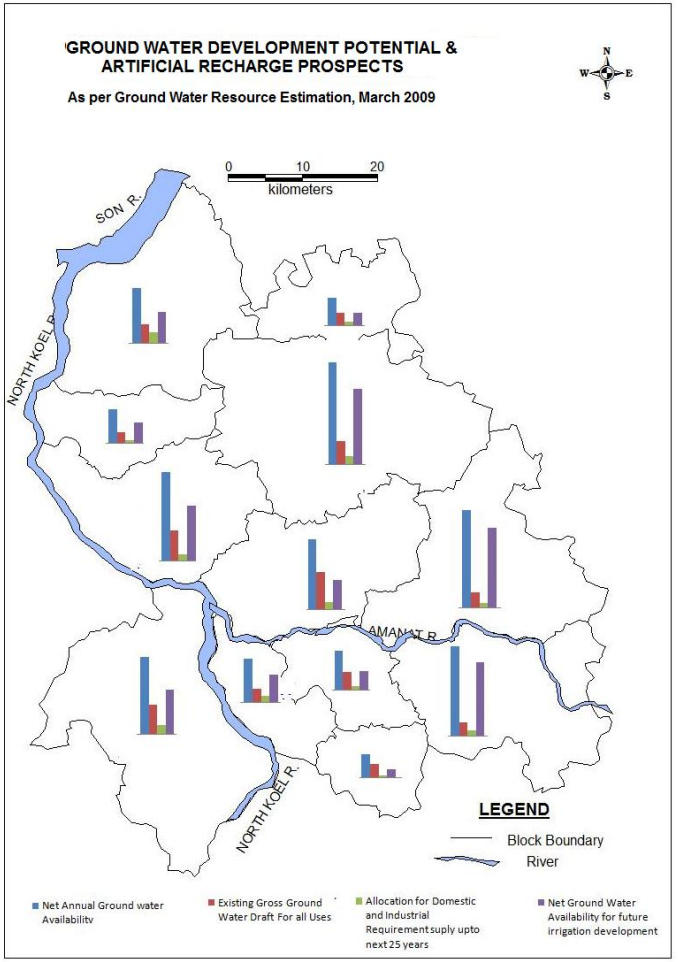


Plate-VII



6.0 GROUND WATER RELATED ISSUES & PROBLEMS

Some of key ground water related issues are

1) Long term water level decline has been observed to the tune of 0.558 m/year at Nawadih, Patan Block.

2) Locating suitable sites for bore wells

3) Suitable design of dug wells and hand pumps

4) Taking up artificial recharge projects to augment the resource availability in Palamu district

5) Optimal development of irrigation intensity by developing ground water available for future uses:

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

7.0 AWARENESS & TRAINING ACTIVITY

7.1 Mass Awareness Campaign (MAP) & Water Management Training Programme (WMTP) by CGWB

One training programme was organized at Gandhi Smriti Town Hall, Daltonganj on 28/02/07 in which over 50 persons participated.

8.0 AREA NOTIFIED BY CGWB/SGWA

None

9.0 RECOMMENDATIONS

In the hard rock areas, pin pointing suitable sites for bore wells is always a challenge. Considering the anisotropy in distribution of fractures at deeper level, proper selection of sites can be arrived at making use of remote sensing techniques in association with geophysical and hydro-geological investigations.

For deriving optimal benefit from aquifers in areas under fissured formation the dug wells should be so designed that it penetrates the weathered zone as well as top part (1-2 m) of the underlying bed rock so as to derive the benefit of the shallow aquifer. For hand pumps and shallow tube wells the casing provided against the weathered zone should be slotted at the bottom so that the well can extract shallow ground water also. In urban areas use of shallow aquifers should be encouraged.

The surface run off in urban areas and its peripheral parts should be harnessed to augment the ground water resource through appropriate techniques. For urban areas roof top rain water harvesting and artificial recharge is most suitable. Location and design of the structures should be guided by hydro-geophysical surveys. Sites for artificial recharge should be taken up if fractures are available and the depth of the recharge well should be governed by the depth of occurrence of fractures. De-saturated or partially de-saturated fractures / aquifers should be properly demarcated.