Govt. of India

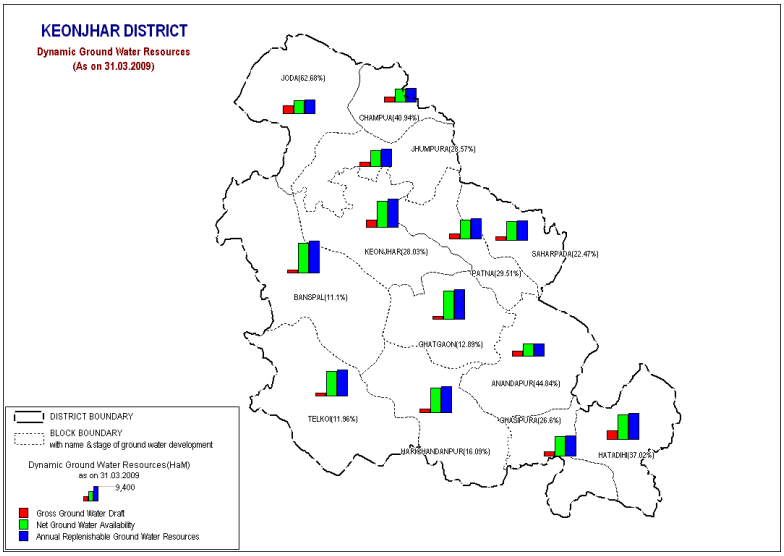
MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

OF

KEONJHAR DISTRICT



South Eastern Region

Bhubaneswar

May , 2013

DISTRICT AT A GLANCE

S.No.	ITEMS	Statistics
1	GENERAL INFORMATION i) Geographical Area (Sq km) ii) Number of Tehsil /Blocks iii) Number of Panchayat / Village iv) Population as on 2001 Census v) Average annual rainfall (mm)	 8303 sq km 8/13 286/2122 1561990 1534.5
2	GEOMORPHOLOGY 1. Major Physiographic Units 2. Major Drainages	 1. Structural hills, 2.Residual and denudational hills 3.Domal granitic outcrops 4.Shallow to moderate buried pediments 5.alluvial plain Baitarani River
3	LAND USE (sq Km)(2003-04) a) Fores Area b) Net Area Sown	 133895 Ha 229893 Ha
4	MAJOR SOIL TYPE	1-Alfisol ,2-Ultisol
5	AREA UNDER PRINCIPAL CROPS (as on 2009-05)	55057 Ha in Kharif & 148149 Ha in Rabi
6	IRRIGATION BY DIFFERENT SOURCES (as on 2004-05) (Area and nos of structures) 1. Major/Medium Irrigation Project 2. Minor Irrigation Project (Flow) 3. Lift Irrigation	Area (in Ha) Kharif Rabi 27873 3868 21696 2906 2645 1727
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (as on 31.3.2007) 1. No of Dug Wells 2. Nos of Piezometers	 57 2
8	PREDOMINANT GEOLOGICAL FORMATIONS	Archean crystalline hard rock
9	HYDROGEOLOGY • Major Water Bearing Formations • Depth to Water Level during 2011 • Post-Monsoon Depth to Water	 Fractured formations and recent unconsolidated formation. 0.58-10.48 m. bgl 0.58-6.29 m. bgl

	Level during 2011 • Long Term water level trend in 10 yrs (1999-2010) in m/yr	43% of wells show Rise within 0.253 m. and rest show and fall within 1.413 m.
10	GROUND WATER EXPLORATION BY CGWB (As on 31.3.2011) No of wells drilled (EW,OW) Depth Range (m) Discharge (lps) Transmissivity(m ²/day)	 EW=49, OW=11 42.30 to 200.2 mbgl Negligible to > 20.20 lps 1.2 to 52 m2/day
11	GROUND WATER QUALITY Presence of Chemical constituents more than permissible limit (e.g. EC ,F,AS,Fe) Type of water	 All within permissible limit except an isolated few patches having more Hexa valent chromium potable
12	DYNAMIC GROUND WATER RESOURCES (2009) 1-Annual replenishable Ground Water Resources 2-Net Annual Ground Water Draft 3-Projected demand for domestic and industrial uses up to 2025 . 4-Stage of Ground Water Development	 81323 (HM) 20775(HM) 2990 (HM) 25.55 %
13	AWARENESS AND TRAINING ACTIVITY Mass Awareness Programme organized Place No of Participants	 Organized Ghatgaon 175
	Water Management and Training Programmes Organized Place No of Participants	Organized Keonjhar 35
14	EFFORTS OF ARTIFICIAL RECHARGE & RAIN WATER HARVESTING Projects complied by CGWB (No & Amount spent) Projects under technical guidance of CGWB (numbers)	Nil
15	GROUND WATER CONTROL AND REGULATION No of OE Blocks	 Nil

	No of Critical Blocks No of Blocks Notified	Nil Nil
16	MAJOR GROUND WATER PROBLEMS AND ISSUES	No major ground water problems exit.

1.0 Introduction

1.1 Administrative details

The Keonjhar district lies between north latitudes 21 01' and 22 10' and east longitudes 85 11' and 86 22' falling in the survey of India toposheet nos 73F, 73G and 73K. It is bounded on the north by the district Singbhum in Jharkhand, on the east by the district of Mayurbhanj and Baleswar, on the south by Jajpur and Dhenkanal and on the west by Sundergarh districts.The district comprises of 3 subdivisions namely Keonjhar sadar, Champua and Anandpur and 13 community blocks with the district headquarter is at Keonjhar. (Plate 1). The geographical area of the district is 8303 sq km.

The district is well connected by roads. The National Highway No. 6 passes through the district from east to west. The NH 215 also passes through the district from south to north connecting Keonjhar with Cuttack and Bhubaneswar. The block headquarters are connected with the district headquarter by all weather roads. The railway communication in the district is not good. The nearest railway station is Jajpur-Keonjhar road, 80 km from Keonjhar.

The total population (2001census) of the district is 1561990 and out of which urban population is only 213012. The scheduled caste and scheduled tribe community accounts for 11.61% and 44.50% respectively of the total population of the district.

1.2 Drainage

The district is mainly drained by the river Baitarani and its tributaries barring a very small patch in the extreme south-western part, falling in Brahmani basin. The major tributaries are Kanjhari, Sitanadi, Salandi, Musal nadi, Orarai nadi, Remal, Kasai and Deo nadi etc. and these are mostly perennial. The drainage pattern is mostly dendritic in nature. Sub-parallel drainage pattern is well developed in the south-eastern part of the district. The drainage density is moderately high in western part of the district representing high hill ranges constituted mostly by Iron ore group of rocks and volcanics which suggest high run off and low infiltratation. Hydrogeological surveys and remote sensing studies have revealed that the drainage pattern in the district is controlled by the fracture system which is developed due to tectonic deformation occurred in the area in several phases.

1.3 Studies carried out by CGWB

The systematic geological mapping and groundwater survey in the district was under taken by Geological Survey of India and later by Central Ground Water Board 1980-1986. Subsequently reappraisal hydrogeological survey was carried out in different parts in the district during 1991-92.

Geophysical resistivity surveys were carried in parts of the district by officers of Central Ground Water Board during the period 1988-91. Under ground water exploration programme a total of 49 nos exploratory wells have been drilled to

delineate deeper potential water saturated fracture zones. Ground water monitoring through 57 hydrograph network stations is being carried out four times in a year.

2.0 Rainfall & Climate

The district is characterized by tropical to sub tropical climate with hot summer, high and well-distributed rainfall during the monsoon and a cold winter. The summer season lasts from March to May, the rainy season starts in June and continues up to September. October and November constitute the autumn season and winter starts in December. May is the hottest month of the year with a maximum temperature is about 46° C and daily minimum temperature 25° C. December is the coldest month as the mean daily temperature recorded as 12° C. Relative humidity is generally high from June to December. In summer season humidity varies from 35-40%.

South-west monsoon is the principal source of rainfall in the district. Average annual rainfall is 1535 mm. About 80% of the total rainfall is received during the period from June to September. On an average there are 79 rainy days in a year. Drought s is common in the district.

3.0 Geomorphology & Soil Types

3.1 Physiography: The Keonjhar district shows conspicuous physiographic variations and mainly represented by high hills/ isolated hillocks/ domal granitic outcrops, vast undulating plains and alluvial tract.

3.1.1 High hills/ Isolated hillocks/ Domal Granitic outcrops : Highly resistant rocks like quartzites, B.H.J. and B.H.Q bearing iron ore group of rocks, proterozoic volcanics and Kolhan sedimentaries constitute these outcrops rising to maximum height of 1062 meters above msl in Sukati and Banspal sector. The Tomka-Daitari Iron ore range exposed in the southwestern part of the district encompasses high hills of Maghananda parbat rising to a height of 1055 meters above msl.

3.1.2 Undulating plains: The undulating terrain stretching from north to the southeast is reversed by numerous isolated hillocks and granitic domes. The height varies from 100m to 602 m.

3.1.3 Alluvial tract: Flat alluvial tract made up of late Pleistocene to recent sediments and occurs in the flood plain of Baitarani river in the south eastern part of the district and is located at a height of about 20-35 meters above msl.

3.2 Soil Types: The distribution of different soil types in the district depends much on its physiographic and lithologic variations. The soil types in Keonjhar district can be broadly divided into two major groups namely Alfisols and Utisols.

3.2.1 Alfisols : These soils predominantely occur in Harichandanpur, Hatadhi, Ghasipura, Anandpur, Ghatgaon, Telkoi blocks. This group of soil can be sub divided into Sandy soil, red loamy soil, red gravelly soil and older alluvial soil. These soils are light textured usually devoid of lime concretions, nitrogen, phosphate and organic matter. The pH value varies from 6.5 to 7.3.

3.2.2 Ultisols: These soils predominantly occur in Champua, Patna, Jhumpura, Keojhar and Sharpada blocks. Essentially these are lateritic, red and yellow soil and red gravelly soil. These soils are poor in nitrogen, phosphate, potassium and organic matter. The pH value varies between 4.5 to 6.0.

As per the agloclimatic classification the district falls in the north central plateau and northeastern coastal plain.

4.0 Ground Water Scenario

4.1 Hydrogeology :

4.1.1 **Water bearing formations**- The water bearing formation of the area can be divided into (a) areas underlain by fractured, fissured and consolidated basement rock formations (b) areas underlain by recent unconsolidated alluvial formations.

(a) Fissured formation- Major parts of the district are occupied by hard crystalline rocks belonging to pre Cambrian age. Of these Singbhum granite, Iron ore group of rocks and proterozoic metavolcanics are extensively developed for ground water. The area has undergone several phases of intense deformations, which are responsible for the development of the deep-seated intersecting fracture system. The Gabbro- anorthosite intrusives exposed near Boula-Nuasahi area are mainly massive and devoid of well-developed fractures due to their relatively younger intrusive origin. The Kolhans and metavolcanics of Iron ore group of rocks are of localized occurrence in relatively inaccessible pockets, and hence hydrogeological potentialas are not much known except in valley areas.

(b) Unconsolidated alluvial formations-The unconsolidated formations consists of laterite and alluvium. Laterites at places are highly consolidated and used as building stones. The laterites have high degree of effective porosity and form potential aquifers commonly tapped in dug wells.

The alluvium comprises an admixture of clay, silt, sand and calcareous concretions in varying proportions. The fan type deposits dominated by boulders, gravels and pebble occur in various places of Telkoi and in the northern parts of Anandpur block. The coarse sediments like sand and gravel form the main repository of ground water. Ground water occurs under both unconfined condition in shallow aquifers and in confined condition in deeper parts.

4.1.2 Occurrence of ground water:

4.1.2.1 Fissured formations: Ground water in the fissured formations occurs under unconfined conditions within the weathered residuum and under semi confined to confined conditions in fractures at depth. The thickness of the weathered zone varies from negligible to 40 m. In general thickness of weathered zone is minimum in Singbhum granite and maximum in proterozoic volcanics. The weathered zone forms the shallow unconfined aquifer. Among all rock types the weathered zone as well as fractured zone in granitic rocks forms better aquifer. In weathered formation the yield on an average varies from 20 to22 m^3 /day. The fractured granitic rock can yield upto 15 lps whereas at Kanjipani proterozoic volcanics yield 25 lps. The fractured zone are mostly confined within 75 to100 m depth and within this depth 2 to 3 fractures are found.

4.1.2.2: Unconsolidated Alluvial formation:

4.1.2.2.1 Quarternary and upper Tertiary sediments: Sands, gravels and pebble form the main aquifer systems in quarternary alluvial deposits under lain by Tertiary sediments. Groundwater occurs under pheratic condition at shallow depth and semi confined to confined in deeper depth in these formation. The shallow near surface aquifers which are mainly exploited by dug wells yield fresh water in the entire district. The yield of the existing dug well varies from 12 to 25 lps. The average depth of these dug well is around 6 to 7 m. The thickness of the alluvium varies from 15 to 95 mbgl. Inference from lithologs of the tube wells drilled by OLIC shows that towards Salandi there is remarkable change from sand to silt.

4.1.2.2.2 Laterites : It generally forms the shallow aquifer and ground water mostly tapped by shallow dug wells. On an average the yield from dug wells in laterites is around 25 to 30 m^3/day with the maximum of 40 to 45 m^3 /day. The specific capacity and transmissivity of lateritic aquifers vary from 0.0016 m^3/min/m to 0.2214 m^3/min/m and 3.2 m^2/day to 506.85 m^2/day.

4.1.3 Ground water Exploration

A total of 49 exploratory and 11 observation wells were drilled in the hard rock terrain of the district. The depth of the wells varied from 50.8 to 200.2m and the yield varied from negligible to a maximum of 20 lps.

In the northern sector, in Jyotipur-Jhumpura-Karanjia-Champua-Joda-Nalda tract, the yield of the exploratory wells varied from 0.8 to 13 lps and the maximum of 13 lps was recorded from well at Champua.

In the Tumunga-Saharapada-Maliposi tract the discharge of the wells was low except at Maliposi (10.77 lps).

In Raisuan-Pipilia-Janghira-Ghatgaon sector generally the saturated zones were encountered at deeper depths. The deepest

water yielding fracture which yielded 5.4 lps, was encountered at a depth of 198m. in the borehole at Keonjhar Sadar.

In the Kanto-Deogaon-Sainkul tract in the southeastern part of the district fifty percent wells yielded more than 5 lps. The high discharge wells are located at Sainkul (7 lps), Sailong (14 lps), Bhalukoma (9 lps), and Anandapur (8.6 lps). The highest discharge of 20 lps was recorded from the well drilled in meta-volcanics at Kanjipani of Banaspal block.

4.1.3.1 Aquifer parameter:

The aquifer parameter of shallow and deep aquifers were determined from the pumping test data conducted during the hydrogeological survey and exploratory drilling. Aquifer characteristics of shallow and deeper aquifers are noted below.

Shallow Aquifers: Near surface aquifer in which ground water occurs under unconfined (phreatic) condition and is mainly tapped by dug wells for ground water extraction is generally identified as shallow aquifer. The specific capacity and hydraulic conductivity in different formations are stated in table 1

Table-1 Specific capacity and hydraulic conductivity in different formations

Formation	Specific capacity index(m^3/min/m)	Transmissivity (m^2/day)
Alluvium	0.0035 to 0.241	4.0 to 102
Laterite	1.1-2.89	3.66-9.23
Older metamorphic group	4 to 39	0.0013 to .0106
Proterozoic volcanics	Transmissivity and Specific capacity in this zone appears to be low.	
Iron ore group (shales, BHJ, BHQ and Kolhans)	Transmissivity and Specific capacity in this zone appears to be low.	
Singbhum granite	1 to 28	0.0009 to 0.034

4.1.3.2 Deeper Aquifers: Aquifers, which occur below the phreatic zone and extends down to a greater depth, are termed as deeper aquifers. Ground water in deeper aquifers occurs under semi-confined to confined conditions. Deeper aquifers are tapped by tube/bore wells for ground water extraction. Characteristics of deeper aquifers are noted below.

Table-2 Specific capacity and hydraulic conductivity in different formations in deeper aquifers

Formation	Specific capacity	Transmissivity (m^2/day)

	index(m^3/min/m)	
Older metamorphic group	2.5 to 38	0.8 to 13
Proterozoic volcanics	0.4 to 80.66	0.24 to 25
Iron ore group (shales, BHJ, BHQ and Kolhans)	11.76 to 21.56	3.4 to 8.6
Singbhum granite	0.77 to 59	0.5 to 9

4.1.4.1 **Depth to water level (Pre & post monsoon 2011**) : The depth to water level map for pre and post monsoon periods 2011 are prepared based on the ground water monitoring data of 57 Nos of National Hydrograph Stations of C.G.W.B. monitored during the month of April and November 2011 are presented in **Plate 2** Plate **3** respectively **.** The pre and post monsoon depth to water levels in the district range from 1.070 to 12.990 m below ground level and 0.210 to 6.560 m below ground level respectively. It is observed that during pre monsoon about 30% of the total areas show the water level varying between 6 to 8 m below ground level. During post monsoon nearly 60% of the area has water levels within 2 to 4 m, while the rest part has between 0 to 2 and 4 to 6 m below ground levels. In localized part of Anandapur and Harichandanpur water level is > 6 mt.

4.1.4.2**Seasonal Fluctuation:** The seasonal fluctuation of water levels with respect to pre and post monsoon periods (2011) varies from nil to 7.80 m. The depth to water levels in different seasons and seasonal fluctuation of water levels are more in central and western part, which gradually decreases towards east.

4.1.4.3 **Long term water level trend in last 10 years:** Long-term trend analysis (2001-2011) of water levels on dug wells shows that in 45 % of wells there is a rising trend where as the rest shows a falling trend. Both rise and fall in general restricted to 1 m.

4.2 Ground Water Resources:

As per the ground water resources assessed during 2009, the total annual replenishable ground water resources in the district is 81323 ham. The block wise ground water resources are given in **Table 3.** Around 4130 ham of the total ground water is used in domestic and industrial water supply. The available ground water resource for irrigation in net terms is 61690 ham**.** Net ground water availability for future irrigation development is 113353 ham. Over all the present level of ground water development is only 25.55 percent in the district with the maximum in Anandapur block viz. 44.84% and minimum in Bansapal block 11.1%. Hence the district as well as all the blocks come under the white category.

Table :-3

Sl. No.	Assessment unit/block	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	Allocation for domestic and industrial requirement supply up to next 25 years	Net ground water availability for future irrigation development	Stage of ground water development (%)
1	Anandapur	3615	1474	147	1621	172	1969	44.84
2	Banspal	8895	864	123	987	146	7885	11.10
3	Champua	3947	1192	424	1616	177	2578	40.94
4	Ghashipura	5880	1391	173.28	1564	233	4256	26.60
5	Ghatagaon	8385	931	149.81	1081	179	7275	12.89
6	Harichandanpur	7470	1033	168.90	1202	226	6212	16.09
7	Hatadihi	7385	2504	229.98	2734	275	4606	37.02
8	Jhumpura	4960	1263	154	1417	173	3524	28.57
9	Joda	3926	637	1824	2461	715	2574	62.68
10	Keonjhar	7966	1865	368.28	2233	239	5862	28.03
11	Patna	5731	1562	128.64	1691	161	4009	29.51
12	Saharapada	5648	1147	122	1269	135	4366	22.47
13	Telkoi	7515	782	117	899	159	6574	11.96
	District Total	81323	16645	4130	20775	2990	61690	25.55

Details of over exploited, critical and semi critical areas – Stage of ground water development shows that all blocks fall under safe category.

3. **Ground water Quality:** The chemical quality of ground water in the district has been assessed on the basis of chemical analysis of ground water samples collected during groundwater monitoring, Hydrogeological surveys and groundwater exploration. The results of the chemical analysis are presented in **Table 4.**

Table 4: Showing chemical constituents in aquifers

Constituent	Shallow aquifer	Deeper aquifer

pH	7.80 – 8.22	8.14 – 8.25
Sp. Conductance (micromohs/cm at 25 C)	85 – 2581	165 – 739
TDS (mg/l)	58 – 1430	106 – 429
Calcium (mg/l)	6 – 92	16 – 86
Magnesium (mg/l)	1.2 – 34	2.4 – 24
Sodium (mg/l)	0.7 – 460	3.2 – 33
Potassium (mg/l)	0.4 – 44	0.2 – 3.5
Bicarbonate (mg/l)	31 – 647	67 – 256
Chloride (mg/l)	7.1 – 776	7.1 – 90
Sulphte (mg/l)	<1 – 32	1.4 – 64
Nitrate (mg/l)	<0.01 – 53	0.1 – 78
Fluoride (mg/l)	0.08 – 20.3	0.21 – 0.61
Total hardness as calcium carbonate	20 – 275	70 - 220

The specific conductance value generally ranges from 85 to 2581µs/cm at 25° C. In general the specific conductance value remains within the range of 1000 µs/cm at 25 ° C except at Buxibaragaon (Harichandanpur block) where the value is of the order of 2581µs/cm.

4.3.1 Suitability of Ground Water for Drinking Purpose : The concentration of major chemical constituents and also the pollutants like fluoride and nitrate content in fresh ground water of shallow and deeper aquifers are well within permissible limit of drinking water specification (Indian Standard 1991). Hence the fresh ground water may be used as safe drinking water source.

4.3.2 Suitability of Ground Water for Agricultural Purpose: Ground water in general is suitable for irrigation purpose. Ground water from shallow and deeper aquifers belongs to C_1S_1 and C_2S_1 class of USSL Classification, which indicates that ground water, in general is fit for most type of crops.

4.4 Status of Ground Water Development (Block wise): Annual ground water draft as on 31.03.2009 in the district for all purposes was 132284 ham and the block wise the same is tabulated in **table-3.**

Over all the present level of ground water development is only 13.29 percent in the district with the maximum in Anandapur block viz. 40.96% and minimum in Banspal block. Block wise development figure indicate that all the blocks come under the white categories. Thus there is ample scope for development of groundwater in the district to augment irrigation potentials through suitable ground water abstraction structure. Based on the hydrogeological conditions of the district the feasibility of various ground water structures with some important features are tabulated in table-5.

Table: 5 Feasibility of various ground water structures with some important features

Hydro-geological setting	Type of structures	Depth range (m bgl)	Dia meter(m)	Probable Yield (lps)	Water lifting device
Crystalline and Semiconsolidated area	Dug wells	10-12	4.5-6	3-5	Turbine pump 2 HP
Alluvial area	Dug wells	8-10	2-4	Upto 5	Turbine pump 2 HP
Alluvial area	Filter point and Shallow tube wells.	Upto 50	15 cm	5-20	Submersible/turbine pump 5HP
Crystalline formation	Medium deep tube/bore wells.	100 – 120 mm	15 cm	Upto20	Submersible /turbine pump 10HP

5.0 Ground Water Management Strategy:

5.1 Ground Water Development:

The ground water development is being done through dug wells, bore wells and tube wells. Tube wells include filter point, shallow and medium deep tube wells. The use of ground water is for both domestic and as well as irrigation purposes.

5.1.1 Ground water for irrigation :

The utilizable ground water resources available for irrigation is 113353 ham and the present draft is only 13977 ham. Hence the balanced resource for irrigation is 99376 ham which indicate that there is a huge scope for ground water development. The irrigation potential, from ground water in term of area, created so far is 14996 ha.

5.2. Ground Water Management:

The balance resources for irrigation and block wise stage of ground water development indicates that there is a huge scope for ground water development. Based on the hydrogeological conditions of the district, the feasibility of various ground water structures and their yield prospects are given in table-5.

5.2.1. Structure suitable for ground water development in different formation:

Depending on the hydroeological condition the abstraction structures suitable in different formations are described below.

Dug wells : Dug wells are feasible in all the blocks of the district. The depth of the dug wells in hard rocks and semi consolidated rocks should be 10 to 12m while the depth of the wells in unconsolidated formations i.e. in the central and eastern part of the district may be 8-10m. The diameter of the wells in both the case (older and recent alluvium) may be 4 to 5m. The expected yield of the wells from unconsolidated formation is upto 50 m^3 / day while in other formation it is up to 40 m^3 / day . The distane between any two dug wells should be kept at least 100m. to avoid interference.

Filter Point Tube Wells: These tube wells are feasible in unconsolidated formation i.e. mainly in central and eastern part of the district. These structure are found very successful on the recent flood plain deposit occurring along the banks of river and stream. The depth of these structures may be 15 to 30m and dia 10cm x 5cm or all through 5 cm. 2 H.P submersible or centrifugal pumps may be fitted. The yield of these wells is generally within 5 lps but field experiences indicate that these wells can yield upto 10 lps, when thick aquifer zones (> 4m) are tapped. These wells can be run for 6 to 8 hours daily.

Shallow Tube Wells: The shallow tube wells are feasible in the unconsolidated deposits. These are feasible in alluvial tract of Baitarani and Kusai rivers.The depth of the shallow tube wells may be restricted within 50 mbgl and the diameter is 15cm. The depth of shallow tube wells may be restricted within 25 to 30 m.. The expected yield is generally within 20 lps and submersible pumps of 3 to 5 H.P may be installed. The spacing between two tube wells should be at least 300m.

Deep tube wells: As the thickness of alluvium gradually increases towards east / southeast (towards Hatadihi) medium deep tubewell may be feasible down to 90 m bgl depending on availability of adequate thickness of aquifer as confirmed through resistivity surroundings.

Borewells: The bore wells are feasible in most part of the area which tap deeper saturated fractures in the depth range of 100 to 120 m.. The depth of the wells should be restricted to 200 m. Yield on an average 3 to 7 lps. The loose zones down to 25 to 30 m. depth may be cased and rest part should be left uncased. Generally 2 to 3 saturated fractured zones occurs within 120m depth. Spacing of wells should not be less than 150m

5.3 Water conservation and artificial recharge:

The scope for artificial recharge exits in hard rock terrain in the district. In most part of the district in Kendujhargarh, Patna, Ghatgaon Jhumpura blocks water levels during post monsoon rest between 2 to 4 m. bgl and on an average below 3m. and during pre- monsoon on an average the water level rests below 6m. depth. The artificial recharge structure like infiltration tank, contour bunding, gully plugging are feasible in the area. In some area in addition to above structures subsurface dykes,

may also be constructed. All these structure will be help in augmenting ground water resources in those areas resulting mitigation of water scarcity during summer.

Saharpara Project: During the 9th plan (2001-2011) the project was taken up in Tamkajadi water shed in Keonjhar Block. The details of the project is as follows:

Area: 15 sq. km
Location: 21 40'43'' 85 53'51''
21 43'35'' 85 57'10''
Rainfall: 990.78mm (Monsoon = 819.86mm, Non-monsoon = 170.92)
Recharge dug wells: 15nos
Renovation of existing ponds: 8 nos
Recharge tanks: 10 nos
Recharge pits: 30 nos
Percolation tanks: 1
Check dam: 3 nos

Volume of recharge = $8.10 * 10^6$
Cost of project = 49.75lac
Average rise of water level (pre-monsoon) = 0.69 to 1.54m (2003)
(post-monsoon) = 0.38 to 2.35 (2011)
% of recharge to total run off = 64%

6.0 Ground Water Related Issues & Problems :

The ground water related issues generally include the water logged area, polluted area and water table depleted area and these are discussed in the following paragraphs**.**

6.1 Water logged area: No area in the district is found to be under water logging condition.

6.2 Ground water quality problems: There is no large scale pollution in the district .

6.3 Water Table Depleted area: The long term trend analysis data of water level from the network station of district indicate that no significant water table depleted area is noted in the district as the hydrograph net work stations have shown both rise and fall in water level and these are restricted within 1 m.

7.0 Awareness & Training Activity :

Mass Awareness Programme organized :
Place : Ghatgaon
No of Participants : 175

Water Management and Training Programme Organised
Place : Keonjhar
No of Participants :35

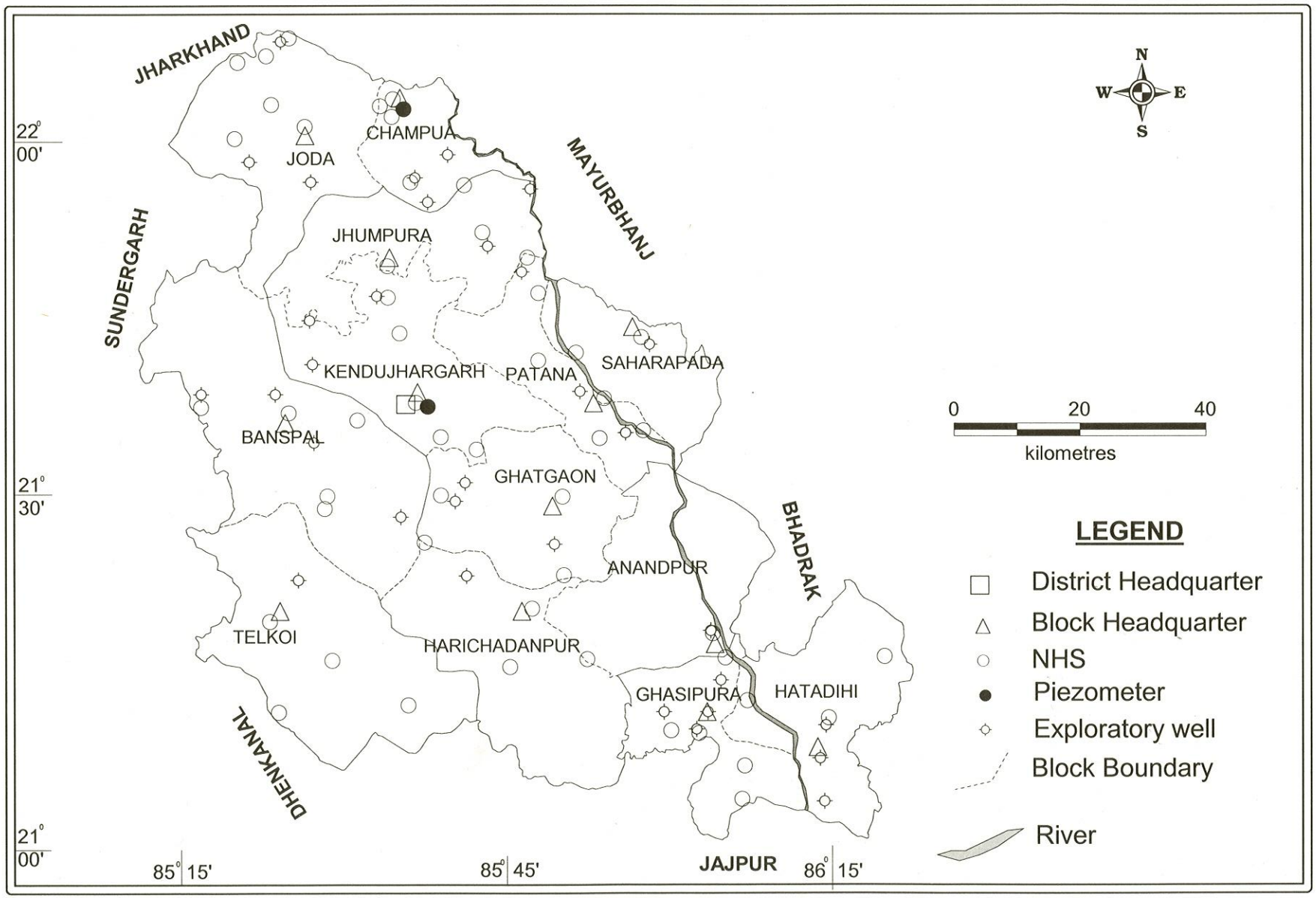
8.0 Area notified by CGWA/SGWA: Nil

9.0 Conclusions:- In Keonjhar district 16365 numbers of dug wells with tenda, 1310 numbers of dugwells fitted with pumps are in operation. The annual draft through these structures is 53.02 MCM while the utilizable groundwater resource for irrigation is 912.39 MCM. Hence the balance groundwater resource available for further development for irrigation is 859.36 MCM, which may tentatively support the construction of additional 154245 dugwells and 100 shallow tubewells in the district. The groundwater development potentials in Keonjhar district generally limited to the vast buried pediment, valley fills, intermontane valleys, laterites and alluvial plains. Exploration has revealed the dug cum bore wells and bore wells are also likely to be successful in the buried pediments, intermontane valleys when sited close to fracture lineaments.

Recommendations:

1) Large scale planning for ground water development should be preceded by intensive hydrogeological and geophysical surveys aided by remote sensing studies.
2) Effective measures may be taken to conserve the surface run off by contour bunding at suitable sites. Also proper maintenance of reservoir, tanks and spring channels by periodical disiltation should be carried out.
3) Existing dugwells should be deepened to tap the maximum saturated thickness of the weathered mantle or vertical bores may be drilled through the bottom to enhance the well yield.
4) Energisation of wells already constructed should be stepped up to ensure optimal utilization of the irrigation potential already created.
5) The farmers should be educated through agricultural extension services fro adopting suitable cropping pattern for optimal utilization of available groundwater resources.
6) Programmes for artificial recharge may also be taken up for augmentation of groundwater through construction of percolation tanks, subsurface dykes, and check dams and through contour bunding etc.
7) An intensive network of groundwater monitoring stations are required to be established in the command areas of irrigation projects to monitor the changes in groundwater regime consequent on application of surface water irrigation.

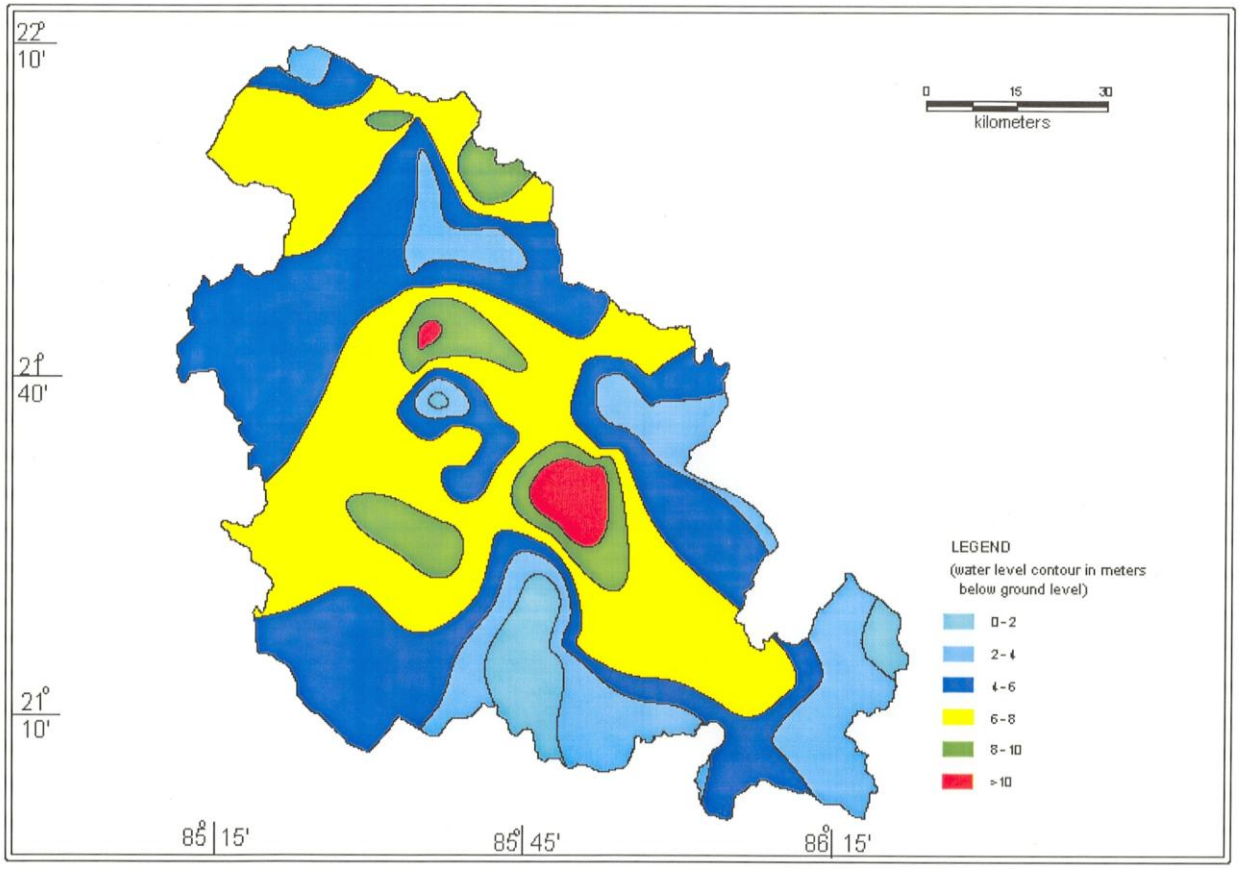
INDEX MAP OF KEONJHAR DISTRICT, ORISSA



PRE-MONSOON DEPTH TO WATER LEVEL MAP OF KEONJHAR DISTRICT, ORISSA

Plate:- 2

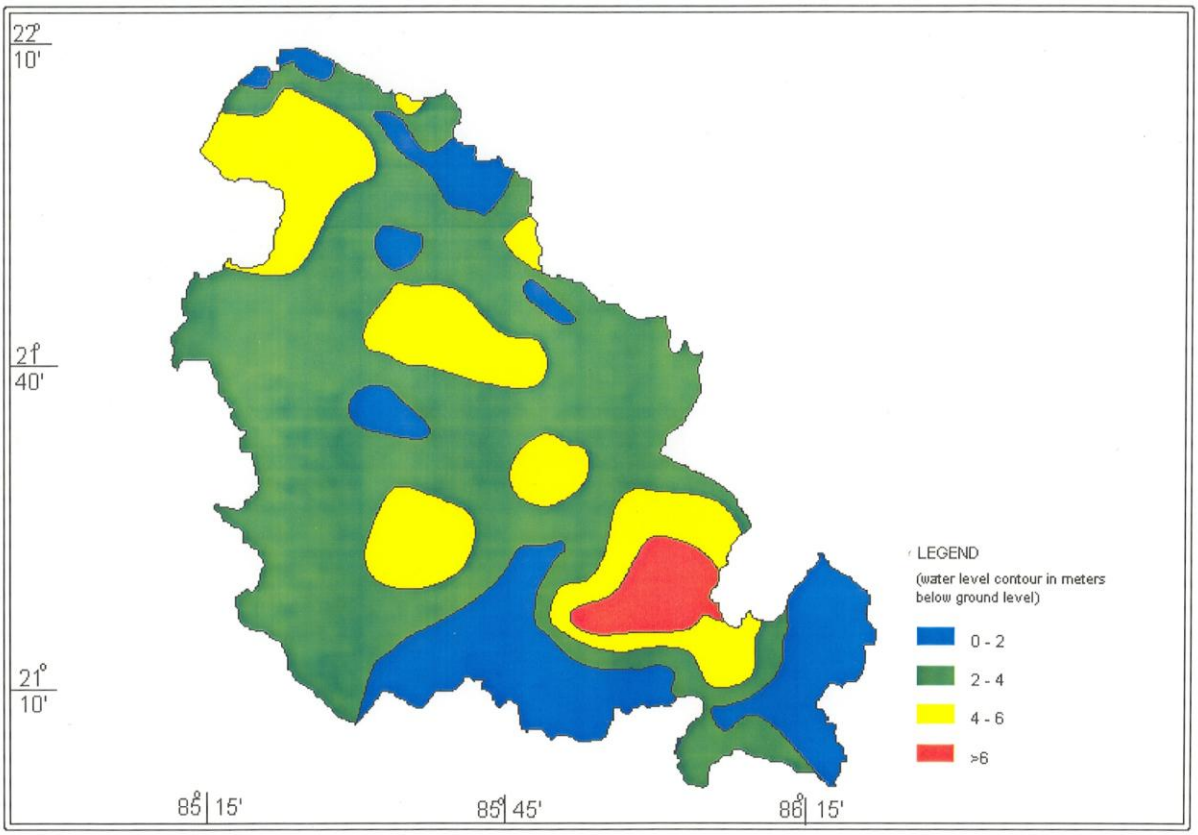
APRIL-2011



POST MONSOON DEPTH TO WATER LEVEL MAP OF KEONJHAR DISTRICT, ORISSA

Plate:- 3

NOVEMBER-2011



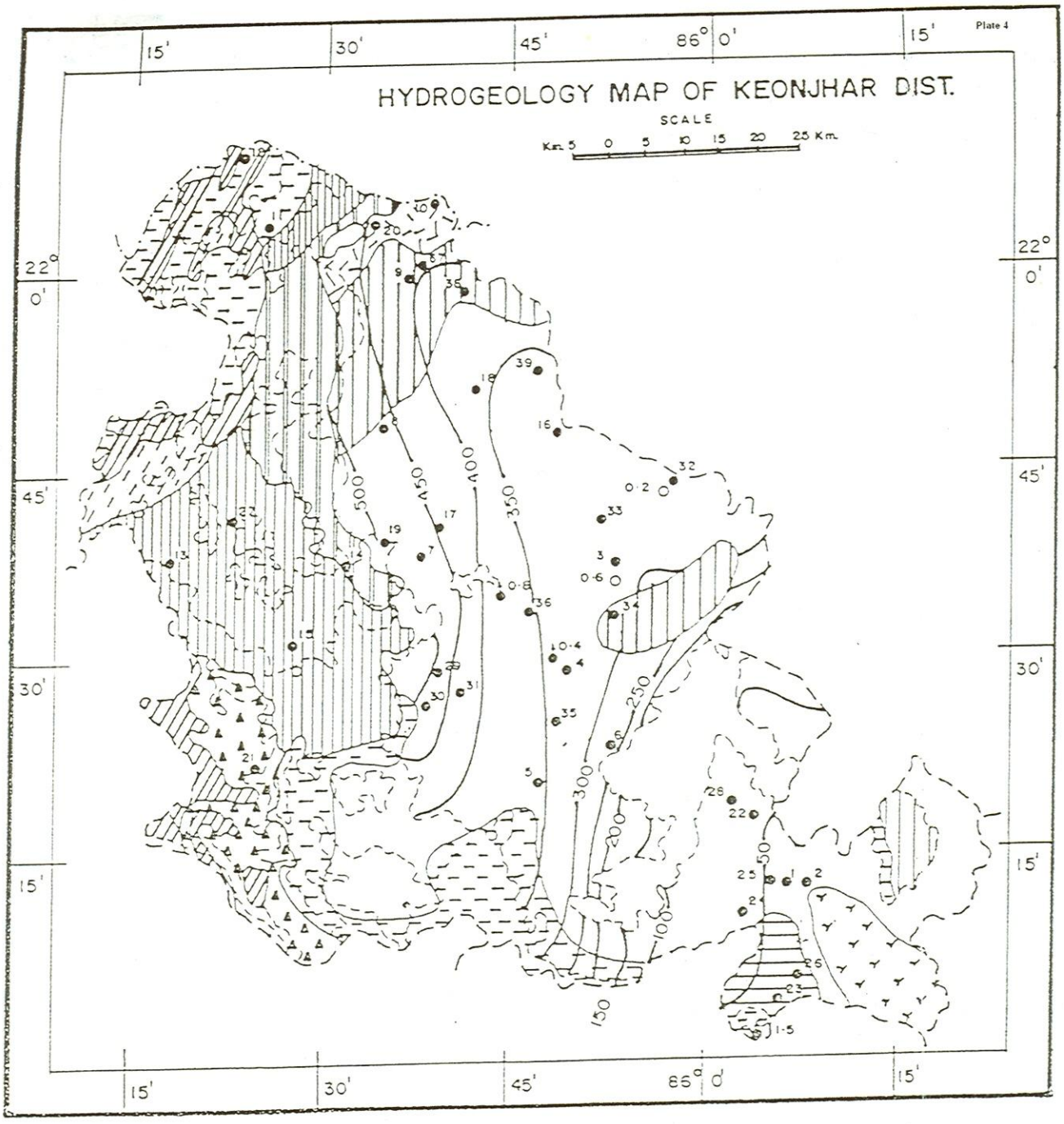


Plate 4
HYDROGEOLOGY MAP OF KEONJHAR DIST.
SCALE
Km. 5 0 5 10 15 20 25 Km.
15'
30'
45'
86° 0'
15'
22° 0'
45'
30'
15'
15'
30'
45'
86° 0'
15'
500
450
400
350
300
250
200
150
100
50

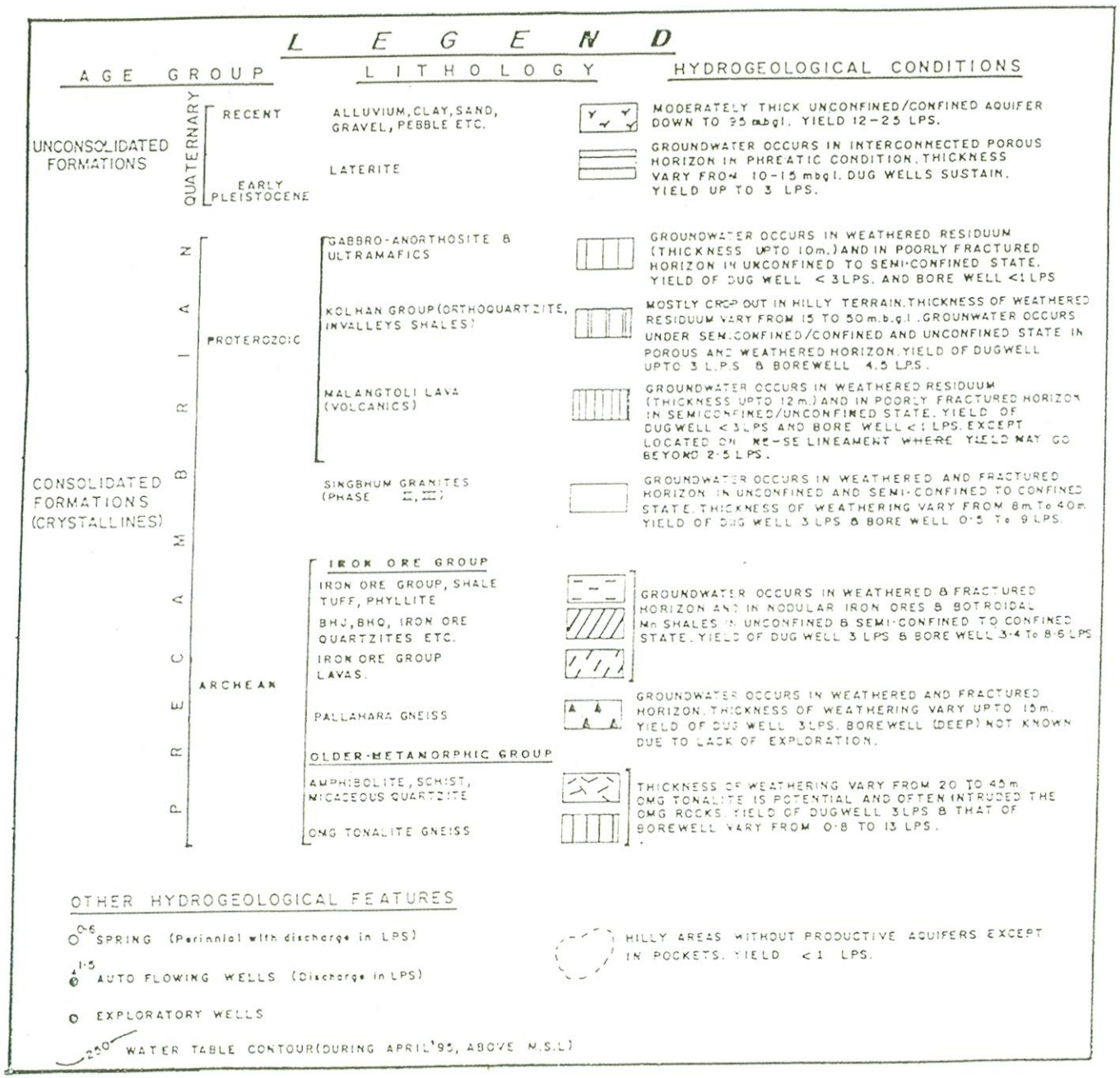
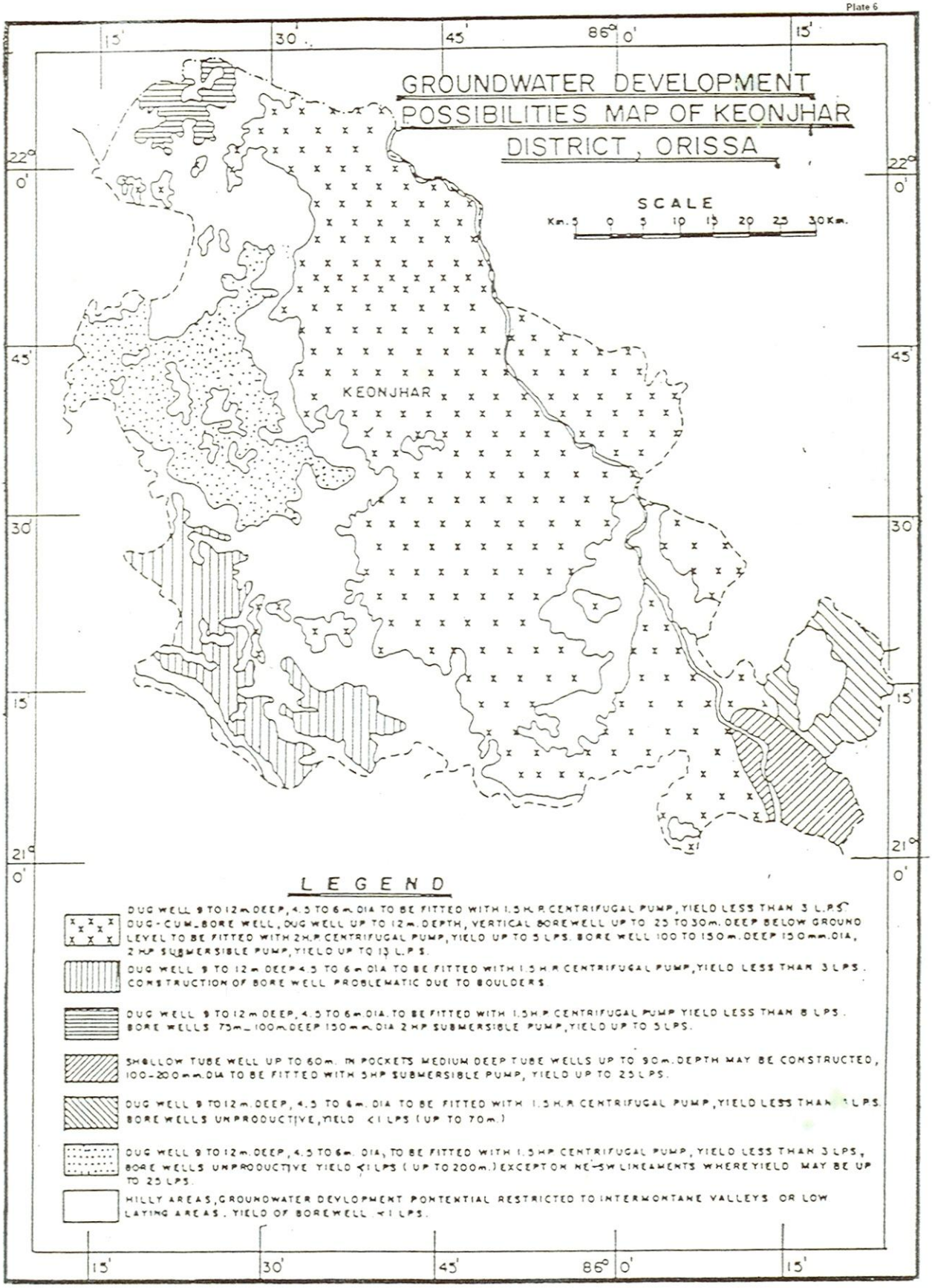
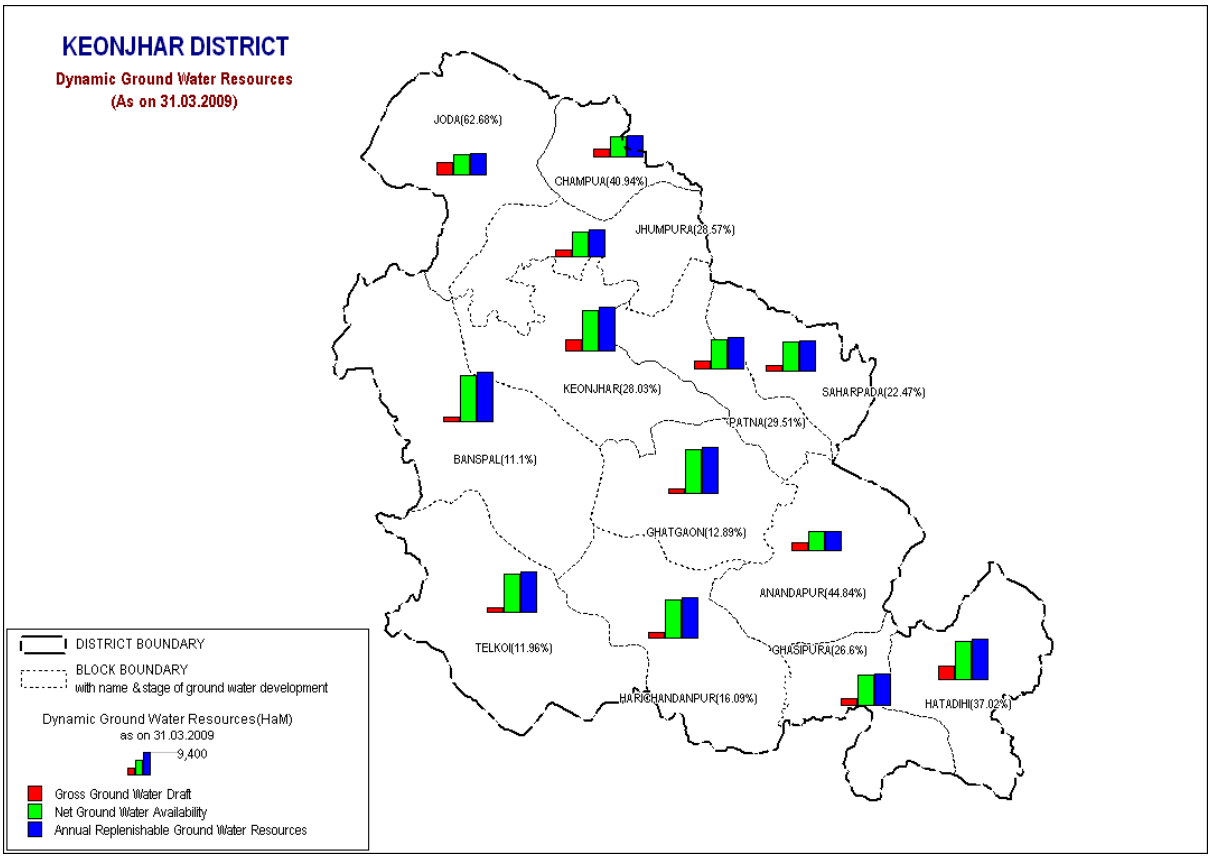
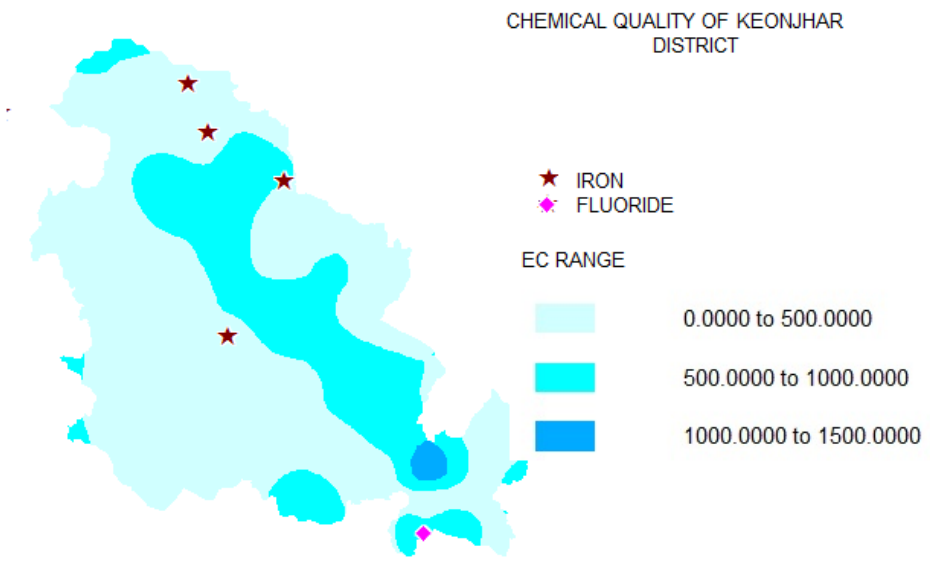

LEGEND
AGE GROUP
LITHOLOGY
HYDROGEOLOGICAL CONDITIONS
UNCONSOLIDATED FORMATIONS
QUATERNARY
RECENT
ALLUVIUM, CLAY, SAND, GRAVEL, PEBBLE ETC.
MODERATELY THICK UNCONFINED/CONFINED AQUIFER DOWN TO 95 mbgl. YIELD 12–25 LPS.
EARLY PLEISTOCENE
LATERITE
GROUNDWATER OCCURS IN INTERCONNECTED POROUS HORIZON IN PHREATIC CONDITION. THICKNESS VARY FROM 10–15 mbgl. DUG WELLS SUSTAIN. YIELD UP TO 3 LPS.
CONSOLIDATED FORMATIONS (CRYSTALLINES)
PRECAMBRIAN
PROTEROZOIC
GABBRO-ANORTHOSITE & ULTRAMAFICS
GROUNDWATER OCCURS IN WEATHERED RESIDUUM (THICKNESS UPTO 10m.) AND IN POORLY FRACTURED HORIZON IN UNCONFINED TO SEMI-CONFINED STATE. YIELD OF DUG WELL < 3LPS. AND BORE WELL <1 LPS
KOLHAN GROUP (ORTHOQUARTZITE, IN VALLEYS SHALES)
MOSTLY CROP OUT IN HILLY TERRAIN. THICKNESS OF WEATHERED RESIDUUM VARY FROM 15 TO 50 m.b.g.l. GROUNWATER OCCURS UNDER SEMI-CONFINED/CONFINED AND UNCONFINED STATE IN POROUS AND WEATHERED HORIZON. YIELD OF DUGWELL UPTO 3 L.P.S & BOREWELL 4.5 LPS.
MALANGTOLI LAVA (VOLCANICS)
GROUNDWATER OCCURS IN WEATHERED RESIDUUM (THICKNESS UPTO 12m.) AND IN POORLY FRACTURED HORIZON IN SEMICONFINED/UNCONFINED STATE. YIELD OF DUGWELL < 3 LPS AND BORE WELL < 1 LPS. EXCEPT LOCATED ON NE–SE LINEAMENT WHERE YIELD MAY GO BEYOND 2·5 LPS.
SINGBHUM GRANITES (PHASE II, III)
GROUNDWATER OCCURS IN WEATHERED AND FRACTURED HORIZON IN UNCONFINED AND SEMI-CONFINED TO CONFINED STATE. THICKNESS OF WEATHERING VARY FROM 8m To 40m. YIELD OF DUG WELL 3 LPS & BORE WELL 0·5 To 9 LPS.
ARCHEAN
IRON ORE GROUP
IRON ORE GROUP, SHALE TUFF, PHYLLITE
BHJ, BHQ, IRON ORE QUARTZITES ETC.
IRON ORE GROUP LAVAS.
GROUNDWATER OCCURS IN WEATHERED & FRACTURED HORIZON AND IN NODULAR IRON ORES & BOTROIDAL Mn SHALES IN UNCONFINED & SEMI-CONFINED TO CONFINED STATE. YIELD OF DUG WELL 3 LPS & BORE WELL 3·4 To 8·6 LPS
PALLAHARA GNEISS
GROUNDWATER OCCURS IN WEATHERED AND FRACTURED HORIZON. THICKNESS OF WEATHERING VARY UPTO 15m. YIELD OF DUG WELL 3 LPS. BOREWELL (DEEP) NOT KNOWN DUE TO LACK OF EXPLORATION.
OLDER-METAMORPHIC GROUP
AMPHIBOLITE, SCHIST, MICACEOUS QUARTZITE
OMG TONALITE GNEISS
THICKNESS OF WEATHERING VARY FROM 20 TO 45 m. OMG TONALITE IS POTENTIAL AND OFTEN INTRUDED THE OMG ROCKS. YIELD OF DUGWELL 3 LPS & THAT OF BOREWELL VARY FROM 0·8 TO 13 LPS.
OTHER HYDROGEOLOGICAL FEATURES
0·6 SPRING (Perinnial with discharge in LPS)
1·5 AUTO FLOWING WELLS (Discharge in LPS)
EXPLORATORY WELLS
250 WATER TABLE CONTOUR (DURING APRIL'95, ABOVE M.S.L)
HILLY AREAS WITHOUT PRODUCTIVE AQUIFERS EXCEPT IN POCKETS. YIELD < 1 LPS.

Plate 6


GROUNDWATER DEVELOPMENT
POSSIBILITIES MAP OF KEONJHAR
DISTRICT, ORISSA
SCALE
Km. 5 0 5 10 15 20 25 30 Km.
KEONJHAR
15'
30'
45'
86° 0'
15'
22° 0'
45'
30'
15'
21° 0'
LEGEND
DUG WELL 9 TO 12 m DEEP, 4.5 TO 6 m DIA TO BE FITTED WITH 1.5 H.P. CENTRIFUGAL PUMP, YIELD LESS THAN 3 L.P.S.
DUG-CUM-BORE WELL, DUG WELL UP TO 12 m. DEPTH, VERTICAL BOREWELL UP TO 25 TO 30 m. DEEP BELOW GROUND LEVEL TO BE FITTED WITH 2 H.P. CENTRIFUGAL PUMP, YIELD UP TO 5 LPS. BORE WELL 100 TO 150 m. DEEP 150 mm. DIA, 2 HP SUBMERSIBLE PUMP, YIELD UP TO 13 L.P.S.
DUG WELL 9 TO 12 m DEEP 4.5 TO 6 m DIA TO BE FITTED WITH 1.5 H.P. CENTRIFUGAL PUMP, YIELD LESS THAN 3 LPS. CONSTRUCTION OF BORE WELL PROBLEMATIC DUE TO BOULDERS.
DUG WELL 9 TO 12 m DEEP, 4.5 TO 6 m DIA. TO BE FITTED WITH 1.5 H.P. CENTRIFUGAL PUMP YIELD LESS THAN 8 LPS. BORE WELLS 75 m - 100 m. DEEP 150 mm. DIA 2 HP SUBMERSIBLE PUMP, YIELD UP TO 5 LPS.
SHALLOW TUBE WELL UP TO 60 m. IN POCKETS MEDIUM DEEP TUBE WELLS UP TO 90 m. DEPTH MAY BE CONSTRUCTED, 100-200 mm. DIA TO BE FITTED WITH 5 HP SUBMERSIBLE PUMP, YIELD UP TO 25 LPS.
DUG WELL 9 TO 12 m. DEEP, 4.5 TO 6 m. DIA TO BE FITTED WITH 1.5 H.P. CENTRIFUGAL PUMP, YIELD LESS THAN 3 LPS. BORE WELLS UNPRODUCTIVE, YIELD <1 LPS (UP TO 70 m.)
DUG WELL 9 TO 12 m. DEEP, 4.5 TO 6 m. DIA, TO BE FITTED WITH 1.5 HP CENTRIFUGAL PUMP, YIELD LESS THAN 3 LPS, BORE WELLS UNPRODUCTIVE YIELD <1 LPS (UP TO 200 m.) EXCEPT ON NE-SW LINEAMENTS WHERE YIELD MAY BE UP TO 25 LPS.
HILLY AREAS, GROUNDWATER DEVLOPMENT POTENTIAL RESTRICTED TO INTERMONTANE VALLEYS OR LOW LAYING AREAS. YIELD OF BOREWELL <1 LPS.


KEONJHAR DISTRICT
Dynamic Ground Water Resources
(As on 31.03.2009)
JODA(62.68%)
CHAMPUA(40.94%)
JHUMPURA(28.57%)
KEONJHAR(28.03%)
SAHARPADA(22.47%)
PATNA(29.51%)
BANSPAL(11.1%)
GHATGAON(12.89%)
ANANDAPUR(44.84%)
TELKOI(11.96%)
GHASIPURA(26.6%)
HARICHANDANPUR(16.09%)
HATADIHI(37.02%)
DISTRICT BOUNDARY
BLOCK BOUNDARY
with name & stage of ground water development
Dynamic Ground Water Resources(HaM)
as on 31.03.2009
9,400
Gross Ground Water Draft
Net Ground Water Availability
Annual Replenishable Ground Water Resources


CHEMICAL QUALITY OF KEONJHAR DISTRICT
IRON
FLUORIDE
EC RANGE
0.0000 to 500.0000
500.0000 to 1000.0000
1000.0000 to 1500.0000