Govt. of India

MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

OF

CUTTACK DISTRICT, ORISSA

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)	 3195 11/14 342 /1950 2341094 1587.4
2	**GEOMORPHOLOGY** 1. Major Physiographic Units 2. Major Drainages	 Deltaic plain, Lateritic upland and Hilly Area Mahanadi River
3	**LAND USE (sq Km)(2003-04)** a) Forest Area b) Net Area Sown	 304.22 1405.72
4	**MAJOR SOIL TYPE**	1-Alfisol ,2-Ultisol ,3-Entisol
5	**AREA UNDER PRINCIPAL CROPS (as on 2004-05)**	13173Ha in Kharif & 129127Ha in Rabi
6	**IRRIGATION BY DIFFERENT SOURCES** Major/Medium Irrigation Project 1. Minor Irrigation Project (Flow) 2. Lift Irrigation	Area (in Ha) Kharif Rabi 61207 36152 15081 1089 10377 9924
7	**NUMBER OF GROUND WATER MONITORING WELLS OF CGWB (as on 31.3.2011)** 1. No of Dug Wells 2. Nos of Piezometers	 45 9
8	**PREDOMINANT GEOLOGICAL FORMATIONS**	1.Fissured Precambrian hard rock and Gondwana semi consolidate formations 2.Porous Alluvium
9	**HYDROGEOLOGY** • Major Water Bearing Formations • Pre-Monsoon Depth to Water Level during 2011 • Post-Monsoon Depth to Water Level during 2011 • Long Term water level trend in 10 yrs in m/yr	 Fissured Precambrian hard rock 1.56-8.17 m. bgl 0.44-5.38 m. bgl Rise and fall within 1 m.

10	**GROUND WATER EXPLORATION BY CGWB (As on 31.3.2011)** No of wells drilled (EW,OW,Pz,SH,Total) Depth Range (m) Discharge (lps) Storativity(s) Transmissivity(m ²/day)	 EW=12, Pz=5,SH=5 62.48 to 300 mbgl Negligible to > 40 lps $1.06x10^{-4}$ to $7.5x10^{-5}$ 305.463 to 8254.77 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 a few patches having more F, and Fe Potable
12	**DYNAMIC GROUND WATER RESOURCES------ (2009)** 1-Annual replenishable Ground Water Resources 2-Net Annual Ground Water Draft (irrigation) 3-Projected demand for domestic and industrial uses up to 2025 . 4-Stage of Ground Water Development	 70646 HM 17732 HM 7175 HM 33.51%
13	**AWARENESS AND TRAINING ACTIVITY** Mass Awareness Programmes organized Date Place No of Participants	 Not Organized
	Water Management and Training Programmes Organised Data Place No of Participants	Not Organized
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 No of Critical Blocks No of Blocks Notified	 Nil Nil Nil
16	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	No major ground water problems exist.

GROUND WATER BROCHURE OF CUTTACK DISTRICT

1.0 Introduction

1.1 Administrative details

The present Cuttack district was formed by curving out Cuttack sadar, Banki and Athagarh sub-division of old Cuttack district during reorganization of districts of Orissa in the year 1992-93. The district is situated in the eastern part of Orissa and lies between north latitudes 20^0 00' & 20^0 40' and east longitudes 84^0 52' & 86^0 01' **(Map -1)**.It falls in 73 D,H and L Toposheets of Survey of India. It is bounded in the north-west by Anugul, in the north by Dhenkanal, in the north-west by Jajpur,south-west by Nayagarh, south by Khurda and south-east by Jagatsinghpur districts. The geographical area of the district is 3915 sq km. The district is well connected by roads and railway lines The N.H. 5 and East Coast railway line connecting Kolkota and Chennai passes through the district touching district head quarters.

The district is divided into 3 sub-divisions namely Cuttack Sadar, Athagarh and Banki, which are further subdivided in to 14 CD blocks with district head quarters at Cuttack. It has 342 nos of gram- panchayats with 1856 inhabited and 94 uninhabited villages and 4 urban areas viz; Cuttack (Municipal Corporation), Choudwar (municipality), Banki (N.A.C) and Athagarh (NAC).

The total population (2001 census) of the district is 23,41,094 and out of which urban population is only 6,09,113. The scheduled caste and scheduled tribe community accounts for 19.08% and 3.57% respectively of the total population of the district.

1.2 Drainage

The Mahanadi River along with its distributaries controls the drainage system of the area and traverses the district from west to east. In the eastern part ie in the deltaic plain the river Mahanadi along with its distributaries form the anastomising drainage pattern. The prominent distrbutaries are Koakhye, Kathjuri, Chitolpala etc.

1.3 Studies carried out by CGWB

The systematic groundwater survey programme in the district was under taken by Geological Survey of India and later by Central Ground Water Board. Subsequently reappraisal hydrogeological survey was carried out in different parts in the district during 1981-82,90-91,91-92 and 95-96.Under ground water exploration programme a considerable numbers of exploratory wells, piezometer, slim holes and deposit wells were constructed in the district.

2.0 Rainfall & Climate

The district is characterized by tropical monsoon climate having three distinct seasons in a year, viz. winter, summer and rainy seasons. Winter commences from late November and continues till end of February. Winter is followed by the summer season, which extends upto mid June. During the period between April and May, 3 to 4 cyclonic rains generally occur in the district. The rainy season sets in the district at the advent of the southwest monsoon, generally from the middle of June and continues till end of September.

Lowest and the highest temperatures recorded for the district are 7.5 ^{0}C and 42.0 ^{0}C respectively. The December and January are the coldest and May is the hottest month. The normal annual rainfall is 1501.3 mm (1950 – 1991) with the average of 1587.4mm. The mean annual wind velocity is 3.4 km/hr. The wind speed during cyclonic storms becomes very high and ranges from 70 to 100 km/hr or even more. Major direction of wind is from south and southwest.

The relative humidity, on an average, varies from 41 to 84% during the year and during monsoon it is much more where as in winter it is less. The mean monthly potential evapo-transpiration varies from 57 mm during January to 320 mm during May.

3.0 Geomorphology & Soil Types

3.1 Physiography: Physiographically the district can be divided into two distinct units viz-deltaic plain and lateritic uplands and hilly tract.

Lateritic uplands and hilly tract : The lateritic uplands and hilly tract is seen in the western part of the district. The Laterite upland bordering the hilly tract is characterized by moderately undulating topography supporting some vegetation. The hilly tract consists of a series of detached hill range s of Pre- Cambrian and upper Gondwana formation. The average altitude varies from 50 to 100 m. above msl with the maximum of 337m. above msl.

Deltaic plains: The deltaic plains occupy the eastern part of the district which is formed under the fluvial environment. The area is characterized by parallel to radial drainage pattern. It forms the most fertile part of the district.

3.2Soil Types: Three types of soils, viz. Alfisols, Ultisols and Entisols occur in the district. As per agroclimatic classification, the district falls under North Eastern Coastal plain.

Alfisols : These soils can be further sub-divided in to red loamy soils, red sandy soils, older alluvial soils and deltaic alluvial soils .The red soils are found in the hilly area in the western part of the district and older alluvial soils are found in minor pockets in northern part. The deltaic soil are found in major parts of the district.

Ultisols**:** These include laterite and lateritic soils, which are found in pockets and characterized by compact to vescicular mass in subsoil horizon composed essentially of a mixture of the hydrated oxide of allumina and iron.

Entisols : These soils include younger alluvial soils occurring along the course of Mahanadi river mainly in western part and central part of the district.These soils are deficient in nitrogen, phosphoric acid and humus, but not in potash and lime.

4.0 Ground Water Scenario

4.1 Hydrogeology :

Water bearing formations- The water bearing formation of the area can be divided into (a) Fissured formation (b) porous type.

(a) Fissured formation- The Pre-cambrian crystallines which mainly consists of granitic rocks ,khondalites and charnockites and occupy western part of the district formed the fissured formation.

(b) Porous formation-The porous formation comprises of semi consolidated Athagarh formation, quarter nary alluvium and upper tertiary sediments, and laterites in limited area. Semi consolidated Athagarh formation occurs in between hard rocks and unconsolidated formation covering the parts of Athagarh, Barang and Tangi-Choudwar blocks It is composed of mainly alternate layer of shale and sandstone. Quaternary alluvial deposits underlain by upper Tertiary sediments occupy half of the district covering the eastern part. The sand, gravel, pebbles horizons form the aquifer system in the area.

Laterites occur as capping over consolidated and semi-consolidated formation. These laterites generally form the shallow aquifer and mostly tapped by dug wells.

4.1a Occurrence of ground water:

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 charnockite and maximum in khondalite. 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 and charnockite forms poor aquifer. In weathered formation the yield on an average varies from 20 to 22 m^3 /day where as in khondalite and charnockite it is 10 to12 m3 /day within the In deeper aquifer the yield potential of granitic is better and in charnockite is very poor. The fractured granitic rock can yield upto 10 lps whereas in charnockite it is restricted to 2 lps. The fractured zones are mostly confined within 100 m depth and within this depth 2 to 3 fractures are found.

Porous formation:

Athgarh formation: In Athgarh formation sandstone mainly forms aquifer systems. The weathered zone in sand stone extent down to a depth of 12to 15 m. The yield of dug well in weathered zone of sandstone is around 20 to 25 m^3 /day. The fractured zones are found to occur down to a depth of 100m. with 2 to 4 sets of fractures and having maximum yield up to 20 lps.

Quarternary and upper Tertiary sediments: Sands, gravels and pebbles form the main aquifer systems in Quarternary alluvial deposits under lain by Tertiary sediments. Groundwater occurs under phreatic condition at shallow depth and semi confined to confined in deeper depth in these formation .At deeper depth granular zones contains both saline and fresh water in the extreme south-eastern part and also in pockets in extreme eastern and north eastern part. 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 30 to 50 m3/day. The average depth of these dug well is around 6 to 7 m.

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.

4.1b 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 (lpm/min/m draw down)	Hydraulic conductivity (m/day)
Alluvium	1.42-3.61	4.72-13.68
Laterite	1.1-2.89	3.66-9.23
Athgarh formation	0.7-2.11	2.78-10.15
Granitic rocks	0.60-2.23	1.89-8.21
Khondalite and Charnockite, etc	0.41-0.82	1.66-3.62

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 aquifer 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.

Consolidated Formation: The specific capacity values for khondalites and Charnockites are low and generally restricted within 0.09 lps/m of drawdown and Transmissivity values are mostly within 4 m^2 /day. While the specific capacity values for granitic rocks may go upto 5 lps/m of draw down. Transmissivity values range between 0.23 and 36 m^2 /day. With the average value ranging from 5 to 10 m^2 /day.

Semi-Consolidated Formation: The specific capacity values in semi consolidated Athgarh formation range from 0.19 to 5.60 lps/m of drawdown and on an average Transmissivity values are mostly within 10.54 to28.76 m^2 /day.

Unconsolidated Formation: The specific capacity values in unconsolidated formation range from 1.46 to 20.2 lps/m of drawdown and Transmissivity values range from198.16 to 8254 m^2 /day. with the average value ranging from 1000 to

2000 m^2 /day. Storativity values calculated from two exploratory wells at Kantapara and Madhab of Niali block were 8.34 X 10^{-4} and 2.11 X 10^{-4} respectively indicating semi confined to confined conditions of aquifer.

4.1c 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 36 Nos of National Hydrograph Stations of C.G.W.B. is presented in Map 2 and 3 respectively. The pre and post monsoon depth to water levels in the district range from 1.56 m to 8.17m below ground level and 0.44 to 5.38 m below ground level respectively. It is observed that during pre monsoon about 80% of the total area show the water level varying between 2 to 5m below ground level and the rest part of the area lying towards the left has the water level between 5 to 10 m below ground level. Water level within 2 m. is found in localised patches around the Bahugram and Jagatpur. During post monsoon nearly 50% of the area has water levels within 2m. While the rest 50% has between 2 to 5m below ground levels.

Seasonal Fluctuation: The seasonal fluctuation of water levels with respect to pre and post monsoon periods (2011) varies from nil to 4.85m.The depth to water levels in different seasons and seasonal fluctuation of water levels are more in western part, which gradually decreases towards east.

Long-term water level trend in last 10 years: Long-term trend analysis of water levels on dug wells shows both rise and fall in 1:1 ratio. Both rise and fall in general restricted to 1 m. except 3 wells where rise and fall are more than 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 70646 ham. The block wise ground water resources are given in Table2. 23674 ham is reserved for domestic and industrial uses. The available ground water resource for irrigation in net terms is **7175 ham.** Over all the present level of ground water development is only 33.51percent in the district with the maximum in Tigiria block viz. 52.89% and minimum in Tangi-Choudwar block(19.88). Hence the district as well as all the blocks come under the white category.

Table-2:Block wise ground water resources

Block	Net Annual Ground water Availability (Ha m)	No of existing ground water structure for irrigation use (March-2004)				Annual draft for Irrigation Use (2004)	Stage of ground water development (%)
		DW with Tenda	DW with pumpset	STW (RIDF)	MDTW		
Athagarh	5365	2257	389	23	-	1421	26.49
Baramba	3882	2042	127	-	-	1034	26.64
Banki	2814	871	77	2	-	602	21.39
Baranga	6273	308	30	315	5	1007	16.05
Cuttack	10677	151	14	604	120	4493	42.08
Damapada	2909	415	30	-	-	340	11.69
Kantapada	10014	140	10	450	23	1479	14.77
Mahanga	12311	179	18	420	24	1620	13.16
Narasinghpur	5973	1983	146	-	-	1038	17.38
Niali	11801	162	11	505	41	1984	16.81
ischintakoili	8785	141	15	503	33	1922	21.88
Salepur	14771	182	7	479	-	1404	9.51
Tangi choudwar	8189	472	36	26	-	556	6.79
Tigiria	1602	1668	89	-	-	741	46.25
District total	105366	10971	999	3327	246	19641	18.64

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

4.3:Ground water Quality :

In general chemical quality of ground water both from shallow and deeper aquifers are good and fit for both domestic and irrigation purposes except in fewer isolated pockets of alluvium where the deeper aquifer has the salinity problem. These patches are restricted to south-east and extremes eastern part of the district. The qualities of shallow and deeper aquifers are described below.

4.3.1 Shallow Aquifers: The ground water is alkaline in nature with pH value mostly ranging from 8.0 to 8.5 with the maximum value of 9.8. The electrical conductance values show a wide range from 59 at Rajnagar to 1043 μS / cm at 25 ^{0}C but in most cases it is between 200-500 μS / cm at 25 ^{0}C. Concentration of dissolved solids varies from 45 to 1224 mg/l and in most cases it is within 200 mg/l. More than 1000 mg/l concentration are noted only at Shankamari(1124 mg/l). Concentration of chloride is within the desirable limit i.e. 250 mg/l except at Kuapal. Nitrate concentration is generally less than the desirable limit except Baramba I and II (55 mg/l), Sardapur,(155 mg/l), Kuapal (94 mg/l) and Madhab(138 mg/l). The fluoride concentration varies from 0.48 to 10.41 and is generally less than1.0 mg/l except at Madhab, (permissible limit 1.5 mg/l). Concentration of iron ranges from non-detectable to 0.49 mg/l at Gunadol(permissible limit 1.0 mg/l). Total Hardness, in all cases is within 250 mg/l (desirable limit 300 mg/l) except except 4 stations at Tigiria, Sardapur, Kuapal and Madhab which shows the concentration more than the desirable limit but within the permissible limit. The concentration of other chemical constituents like Calcium, Sulphate and Phosphate are within the desirable limit in most cases and rest is well within the permissible limit.

4.3.2 Deeper Aquifers: The pH value ranges from 6.73 to 8.15 with the majority of the value ranging between 7.0 and 8.0 which indicate ground water from deeper aquifers is generally alkaline in nature. The electrical conductance values ranges from 150 to 1149 μS / cm at 25 ^{0}C. The electrical conductance values are generally less in non-saline area while in saline hazard area it is more and the values are generally around 1000 μS / cm at 25 ^{0}C. The concentration of total dissolved solids ranges from 16 to 455mg/l. The chloride content varies from 11 to 85 mg / l while in non-saline hazard area it ranges from 89 to 230 mg/l with the majority of the values lying within 150 mg/l. Nitrate concentration in deeper aquifers is limited to 18 mg/l and fluoride content varies from 0.16 to 1.24 mg/l, which indicate that concentration of both the pollutants in deeper aquifer are well within the permissible limit, which are 100 mg/l for nitrate and 1.5 mg/l for fluoride. The concentration of iron varies from 0.05 to 0.67 mg/l against the permissible limit of 1.0 mg/l. Total hardness varies from 16to 455 mg/l against the desirable limit of 300 mg/l. The concentration of other chemical constituents like Calcium, Sulphate and Phosphate are within the desirable limits.

4.3.3 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.

4.3.4 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 except in local pockets like Tigiria and Gopalpur where C_3 S_1 types of water occurs in shallow and deeper aquifer respectively belong to low alkaline and medium to high salinity class. In these pockets salt tolerant crops should be grown.

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 23674 ham and the block wise the same is tabulated in table-2.

Over all the present level of ground water development is only 33.51 percent in the district with the maximum in Tigiria block viz. 52.89% and minimum 19.88% in Tangi-Choudwar 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-3

Table: 3 Feasibility of various ground water structures with some important features

Hydro-geological setting	Type of structures	Depth range (m bgl)	Dia meter(m0	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
Athgarh formation	Medium deep tube/bore wells.	60-100	15 cm	Upto20	Submersible /turbine pump 10HP
Alluvial area	Medium deep tube wells	Upto 150	25 cm* 20cm	>30	Submersible/turbine pump 15 HP
Alluvial area	Deep tube wells	Upto 300	25 cm* 20cm	>30	Submersible/turbine pump 15 HP

5.0 Ground Water Management Strategy:

5.1Ground Water Development:

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

5.1a Ground water for urban and rural water supply:

Urban and rural water supply is mainly met from ground water source. The status of ground water drawn from water supply in urban areas is shown in table-4.

Table-4. **Ground water drawn from water supply in urban areas**

Name of urban area	Supply per day(MLD)	Source of supply	
		Hand pump tube well	Deep tubewell
Athagarh	1.33	43	10
Banki	1.0	34	10
Chaudwar	1.0	32	8
Cuttack	108.27	4	64

In rural areas, R.W.S.&S, Govt. of Orissa has constructed numbers of hand pump fitted tube well to provide safe drinking water to the rural population. The rural people have also constructed dug wells tube wells etc to met up domestic need by investing their own resources.

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 in all the blocks of the district. Based on the hydrogeological conditions of the district, the feasibility of various ground water structures and their yield prospects are given in table-3. The balance resources can be extracted by constructing additional 15532 nos of dug well ,2303 filter point tube well and 315 nos of medium deep tube well in the district.

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 up to 50 m^3 / day while in other formation it is up to 40 m^3 / day. The distance 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 structures 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 diameter 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 up to 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 in the eastern part of the district except in saline hazards pockets of

Mahanga and Nischintakoili blocks. The depth of the shallow tube wells may be restricted within 50 mbgl and the diameter is 15cm. In marginal alluvium area of Baranga and Tangi-Choudwar blocks 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.

Medium Deep Tube Wells *:* The medium deep tube wells are feasible in the eastern part covering Kantapada, Niali, Nischintakoili and Mahanga blocks and also in parts of Cuttack and Baranga blocks particularly in the eastern part. Though the depth of tube well is up to 150 m., but in parts of Niali block the depth should be restricted within 70 to 80 m. because of hydrogeological conditions. In the western and central part Cuttack block and in central part of Baranga block carbonaceous shale occurs at 70 to 80 m. depth. and in the extreme south eastern part of Niali block (in and around Madhab) saline water aquifer exists below 80 m. depth. On an average, within the depth of 80 m, 20 to 25 m, thick aquifer zones are generally encountered and down to 150 m depth, 35 to 40 m thick aquifer are encountered. In saline hazard pockets of Mahanga and Nischintakoili blocks the medium deep wells may not be feasible because saline water zones occurs 25 - 30 m and 150 - 160 m. depth. The diameter of these tube wells should be 25 x 20 cm. And submersible pump of 10 or more H.P. may be fitted. Yield is generally more than 30 lps. The distance between two tube wells should not be less than 500 m.

Deep tube wells: Deep tube wells down to a depth of 300 m. are feasible in the eastern part of Mahanga and Nischintkoili blocks. The cumulative thickness of aquifer zones within 300m. depth is generally 30 to 50 m. The average Yield of the well is generally more than 30 lps. The diameter of the well may be 25 x 20 cm. And submersible pump of 10 or more H.P. may be installed. The distance between any two wells should not be less than 500 m.

Borewells: The bore wells are feasible in Athgarh formations (sandstone and shale of upper Gondwana group) of Baranga and Tangi - Choudwar blocks. The depth of the wells should be restricted to 100m. Yield on an average is 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 occur within 100m. depth. Spacing of wells should not be less than 150m.

TABLE-5: Specification Of Various Structures In Different Hydro-Geological Environment

Hydro-geological Environment	Type of structures	Specification of structures	Yield Prospect	Water lifting device
Non-Saline area	Dug wells filled with pumps	8-10 m deep (laterite & older alluvium) 6-8m (in recent alluvium) Dia-4m	Upto 45m^3/ day	Submersible pump 2-5HP
	Filter point tube wells	15 to 30m deep 10cm x 5 cm dia	Upto 5 lps.	Submersible pump 2-5HP
	Shallow tube wells.	Upto 50m deep 15cm dia	Upto 15 Lps.	Submersible/turbine pump 5HP
	Medium deep tube wells.	Upto 150m deep 25cm x 20cm dia	30 to 50 lps	Submersible /turbine pump 10HP
Saline area	Deep tube wells for tapping fresh water zones	Upto 200m deep (tihidi-Pirhat- Aradi- Suryapur area) upto 300m deep (Rest area) dia 25x 20cm	30 to 50 lps.	Submersible/turbine pump 15 HP

5.3 Water Conservation And Artificial Recharge:

The scope for artificial recharge exits in hard rock terrain in western part of the district in parts of Narsinghpur, Baramba and Tigiria blocks. In this part 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. Physiographically the area shows low hiils with intermontance valley or pediplanes dotted with low hills. 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.

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: The depth to water level map of pre-monsoon period indicates that water-logging condition is found in small patches in extreme south-eastern part of NischintaKoili block and also in extreme eastern and south –eastern part of the district as the premonsoon water level is less than 2 m. However water-logging condition is restricted to low lying area and local depression, in canal command area and occurs in pockets. The permanently water logged area s occur in very minor isolated pockets only.

6.2 Ground water quality problems: There is no large scale pollution in the district except in some isolated patches where concentration of some pollutants like fluoride and nitrate are found higher which are described below.

The higher concentration of nitrate (>45mg/l) from pheratic aquifer are noted from Sardhapur (Narasinghapur Block) and Jagatpur. The higher concentration of fluoride is noted only from the dugwell water of Madhab (Niali Block) while the tube well water from madhab contains only 0.67 mg/l of fluoride. Hence this higher concentration may be very localized phenomenon. Similarly the higher concentration of chloride noted in Sankamari village of Baramba block is also a localized phenomenon as the other wells around this hydrograph station show low contents viz less than 100 mg/l.

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.

6.4 Salinity Problem: Salinity problem is found only in deeper aquifer in the southern part of Niali block and also in small pockets of Mahanga and Nischintakoili block. In Niali block saline water bearing aquifer occurs below 100 m. depth and extends beyond 300 m. depth. At Mahanga and Nischintakoili saline zone extends down to 80 to 150 m. at pockets barring a few metre (up to 30 to 40 m.) at the top.

7.0 Awareness & Training Activity:

7.1 Mass Awareness programme (MAP) & Water Management Training Programme, (WMTP) by CGWB : Not organized

7.2:Participation in Exhibition, Mela , Fair etc: No participation

7.3:Participation & Lectures delivered in public forum/ radio/TV//Institution of Public Repute/ Grassroots associations / NGO/ Academic Institutions etc : Nil

8.0 Area notified by CGWA/SGWA: Nil

8.0 Recommendations:

a) The development of ground water on such large scale requires blocks as well as Gram Panchayat wise large-scale detailed hydro geological study. For this purpose intensive hydro geological surveys and exploratory drilling aided by remote sensing and geophysical investigation may be taken up jointly by the State and Central govt. agencies. This will help in precise delineation of areas suitable for different structures as also fresh water/ saline water distribution. This will also help in determination of precise design of different type of ground water structures and specification of pumps etc. for different part of the district.

b) To avoid failure of tube wells in saline hazard tract it is essential to precisely, identify the fresh water aquifers, through borehole geophysical logging, Cement sealing should also be invariably done precisely to seal off the saline aquifers. Over exploitation may disturb the hydro chemical balance of fresh and saline water leading to saline water ingress. Proper care should be taken to avoid it. Clustering of tube wells should be avoided in the saline hazard tracts..
c) The scope of conjunctive use of surface and ground water may also be studied in the command areas of Delta stage I & II irrigation project areas to avoid problems like water logging, soil salinity etc.
d) People participations is essential for large scale development of ground water financial institution and bankers should extend necessary co-operation to farmers. CESU and Rural electrification Corporation (REC) should also take steps for energization of wells to ensure optimum utilization of ground water resources.

PLATE-I

ADMINISTRATIVE MAP OF CUTTACK DISTRICT

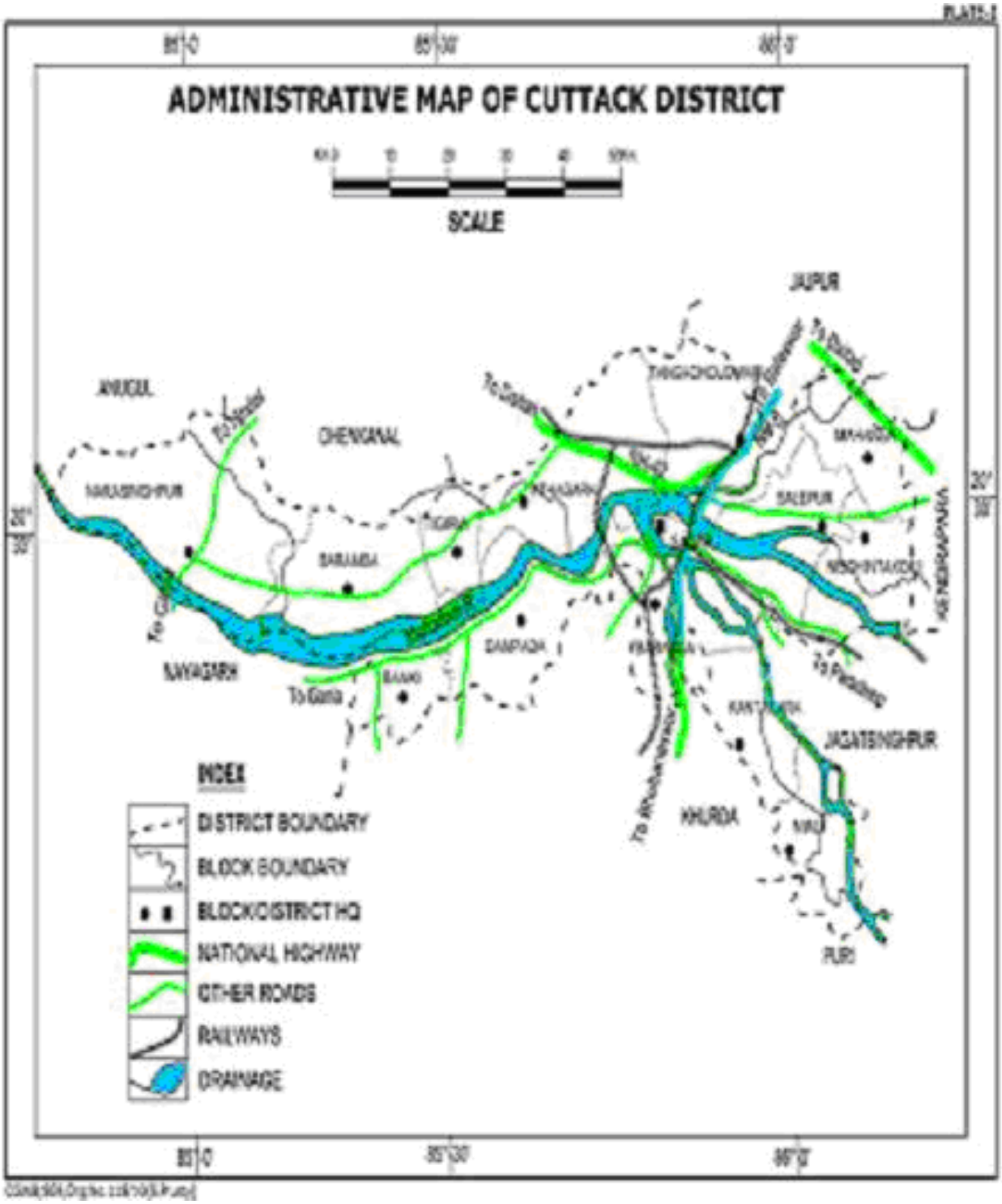
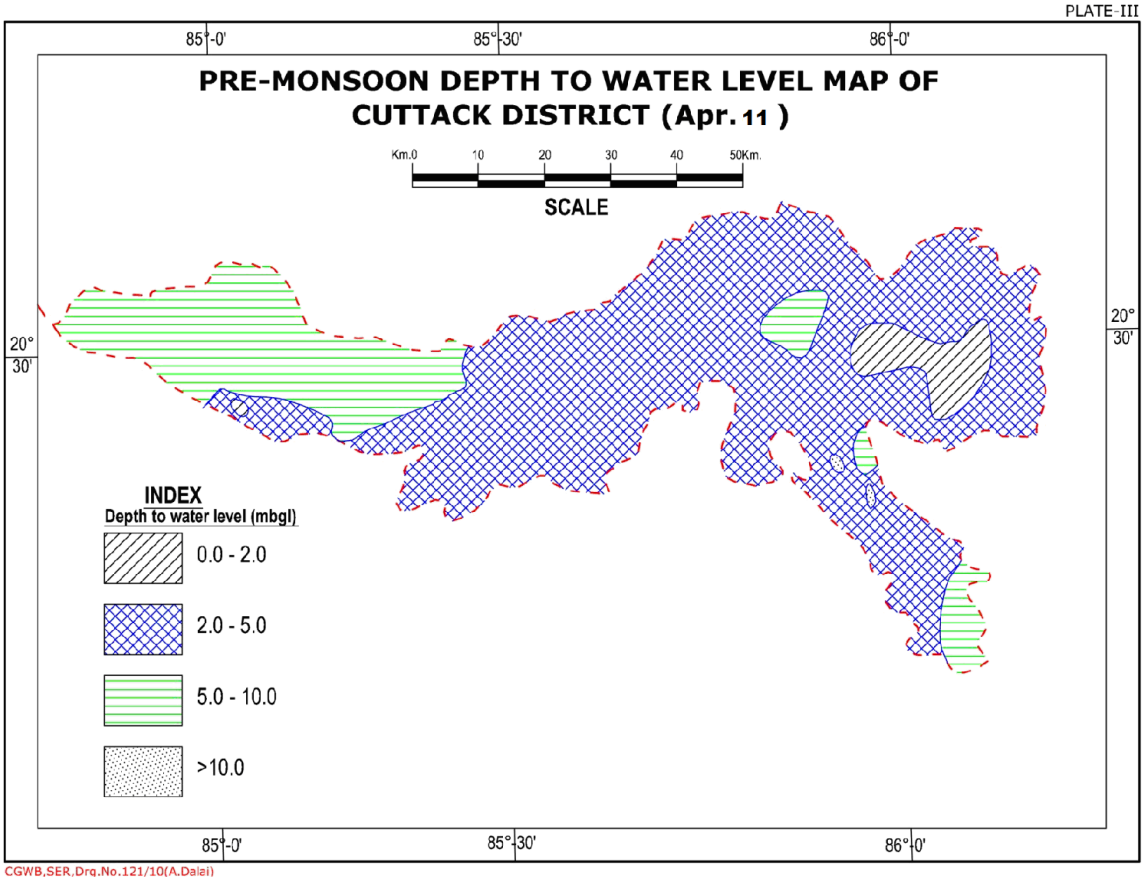
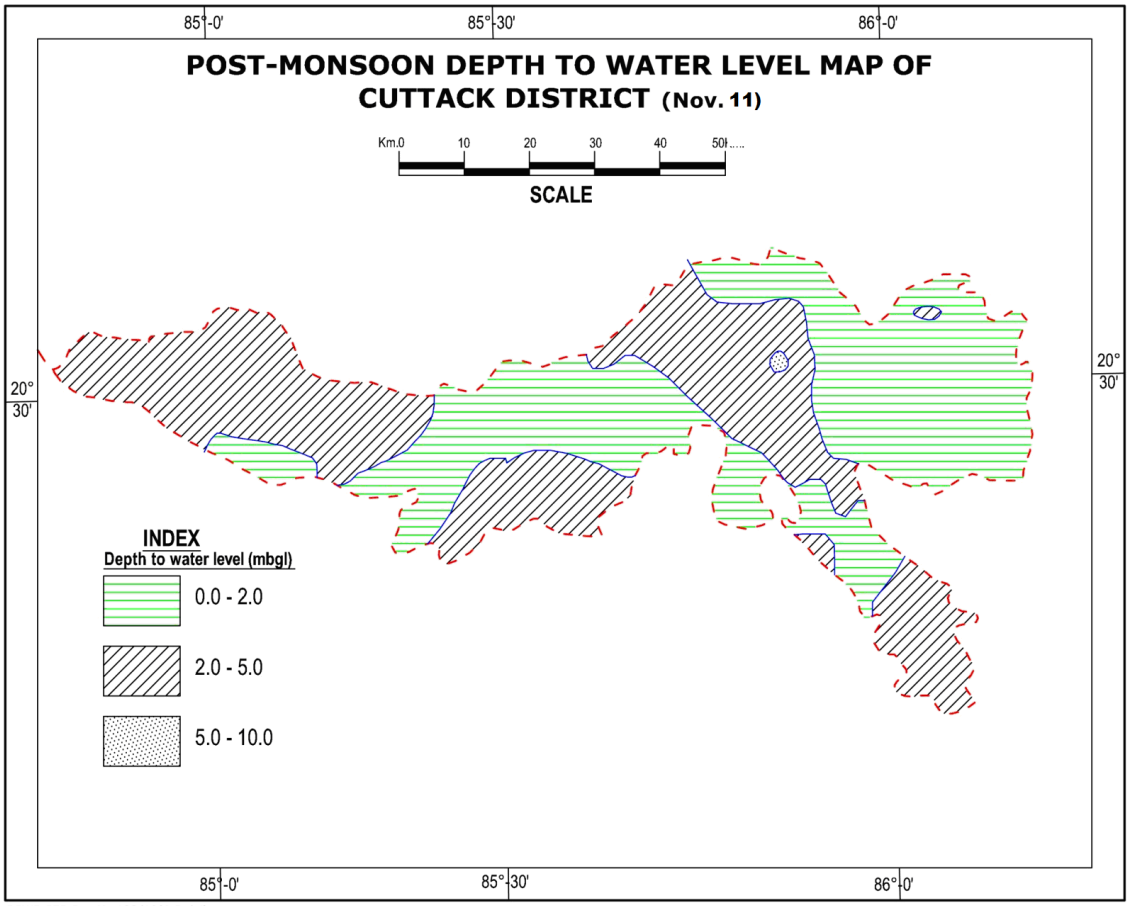


PLATE-III



CGWB,SER,Drg.No.121/10(A.Dalai)

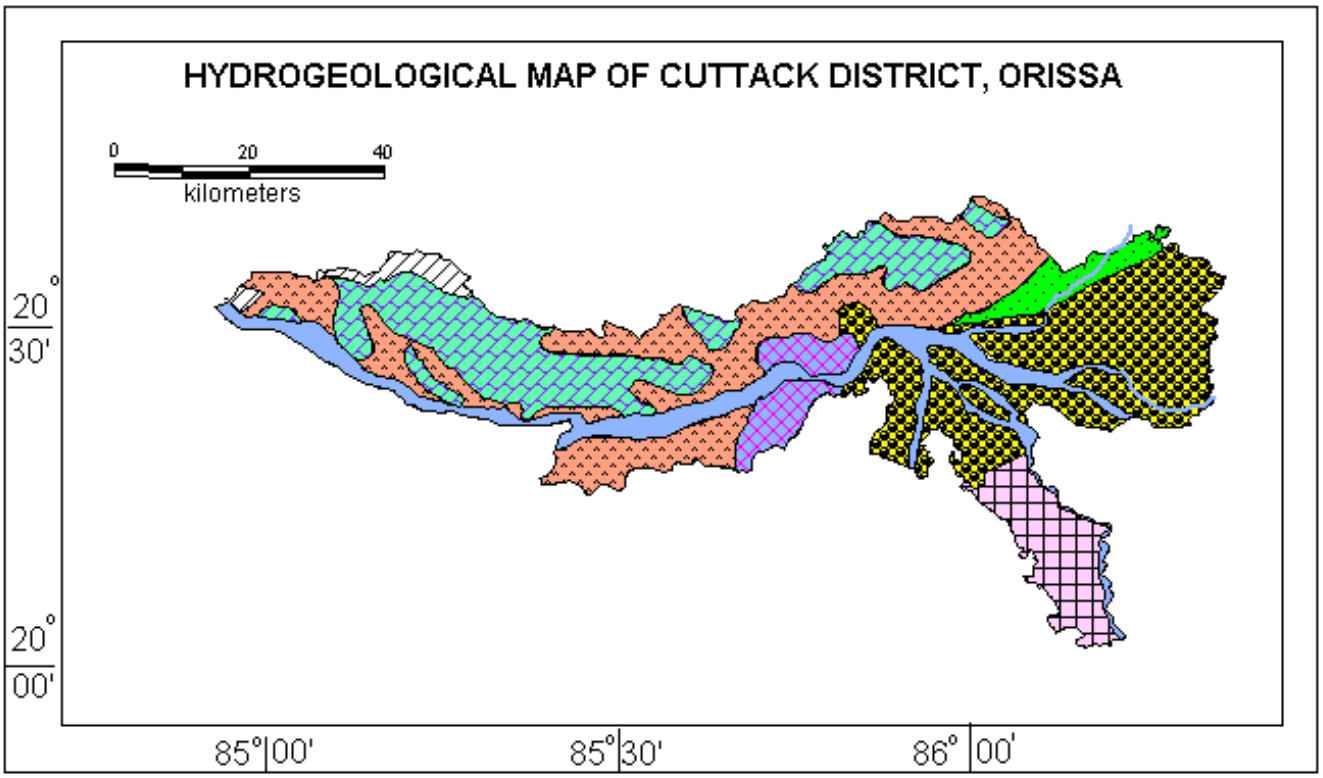
PLATE-IV



CGWB,SER,Drg.No.122/10(A.Dalai)

Map :- 4

HYDROGEOLOGICAL MAP OF CUTTACK DISTRICT, ORISSA

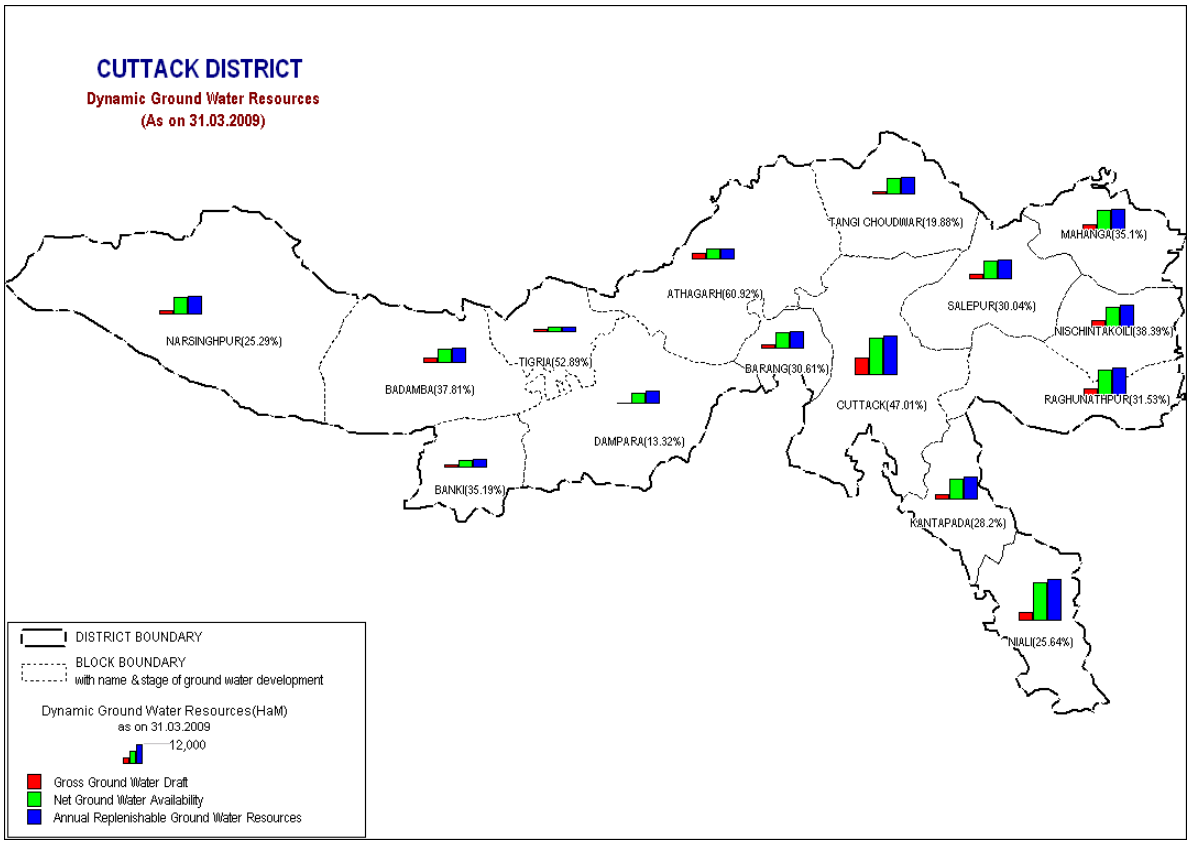


LEGEND

	AGE GROUP	LITHOLOGY	HYDROGEOLOGICAL CONDITIONS	
UNCONSOLIDATED FORMATION	QUARTERNARY	Recent alluvium, clay, sand, gravel pebbles	Fairly thick Regionally extensive unconfined/confin down to 300 m., large yield prospect	POROUS FORMATION
		Older alluvium and laterites, silt, sand ferruginous/calcareous concretion, lithomergic clay etc	Moderately thick and regionally extensive confined/u aquifer down to150m., moderate yield(Average 12	
SEMI-CONSOLIDATED FORMATION	MESOZOIC	Silt stone, clay, stone, grit, sand stone, Shale, conglomerate etc	Moderately thick, discontinuous confined/unconfined aquifer moderate yield (Average 3-5 lps)	
CONSOLIDATED FORMATION	PRECAMBRIAN	Khondalite, charnockite and calc silicate rocks	Ground water is restricted to weathered residium and fracture zone — Low yield, generally < 3 lps	FISSURED FORMATION
		Granite and granite gneiss	Moderate yield, 2-5 lps	
		Hilly area without productive aquifer except in pockets	Yield <1 lps	

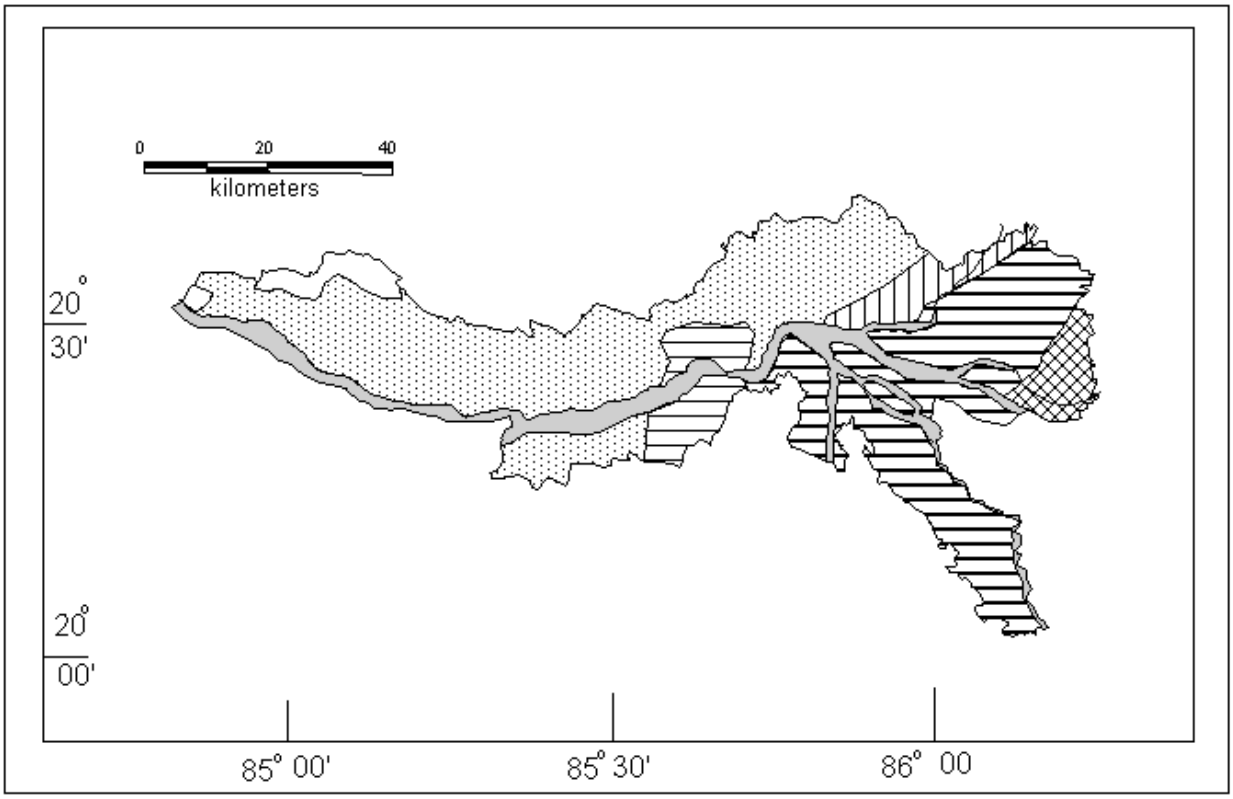
HYDROCHEMICAL CONDITION

Area where saline ground water is overlain by fresh groundwater


CUTTACK DISTRICT
Dynamic Ground Water Resources
(As on 31.03.2009)
TANGI CHOUDWAR(19.88%)
MAHANGA(35.1%)
ATHAGARH(60.92%)
SALEPUR(30.04%)
NISCHINTAKOILI(38.39%)
NARSINGHPUR(25.29%)
TIGRIA(52.89%)
BARANG(30.61%)
BADAMBA(37.81%)
CUTTACK(47.01%)
RAGHUNATHPUR(31.53%)
DAMPARA(13.32%)
BANKI(35.19%)
KANTAPADA(28.2%)
NIALI(25.64%)
DISTRICT BOUNDARY
BLOCK BOUNDARY
with name & stage of ground water development
Dynamic Ground Water Resources(HaM)
as on 31.03.2009
12,000
Gross Ground Water Draft
Net Ground Water Availability
Annual Replenishable Ground Water Resources

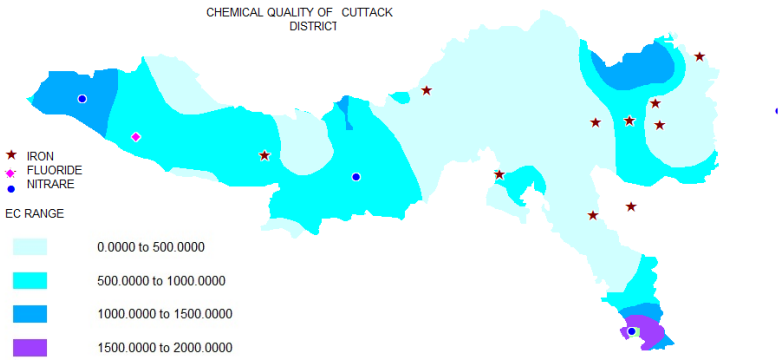
Map :- 6

GROUND WATER DEVELOPMENT POSSIBILITY MAP OF CUTTACK DISTRICT, ORISSA



LEGEND

STUCTURE	DESIGN, PUMP SPECIFICATION, EXPECTED YIELD
DUGWELL	10-12m. DEEP,4.5TO 6m.DIA,CENTIFUGAL PUMP,1 TO 1.5HP, YIELD UPTO 45 m^3 / day
BORE WELL	100 m. DEEP,15cm.DIA,SUBMERSIBLE PUMP, 2 TO 5 HP YIELD UPTO 20 lps (AVERAGE 3-7 lps)
FILTER POINT	15 TO 30 m. DEEP,5 to 10 cm.DIA, CENTIFUGAL/SUBMERSIBLE PUMP, 2 HP, AVERAGE YIELD 5lps
SHALLOW TUBE WELL	30 TO 50 m. DEEP,15 cm.DIA, SUBMERSIBLE PUMP,3 TO 5 HP AVERAGE YIELD 12 TO 15 lps
MEIUM DEEP TUBE WELL	> 50 TO 150 m. DEEP, 25*20 cm. DIA, SUBMERSIBLE PUMP,10 OR MORE HP, YIELD MORE THAN 30 lps.
DEEP TUBE WELL	UP TO 300 DEEP, 25 * 20cm. DIA, SUBMERSIBLE PUMP, 10 OR MORE HP, YIELD > 30lps.
HILL & FOREST	


CHEMICAL QUALITY OF CUTTACK DISTRICT
IRON
FLUORIDE
NITRARE
EC RANGE
0.0000 to 500.0000
500.0000 to 1000.0000
1000.0000 to 1500.0000
1500.0000 to 2000.0000