Govt. of India

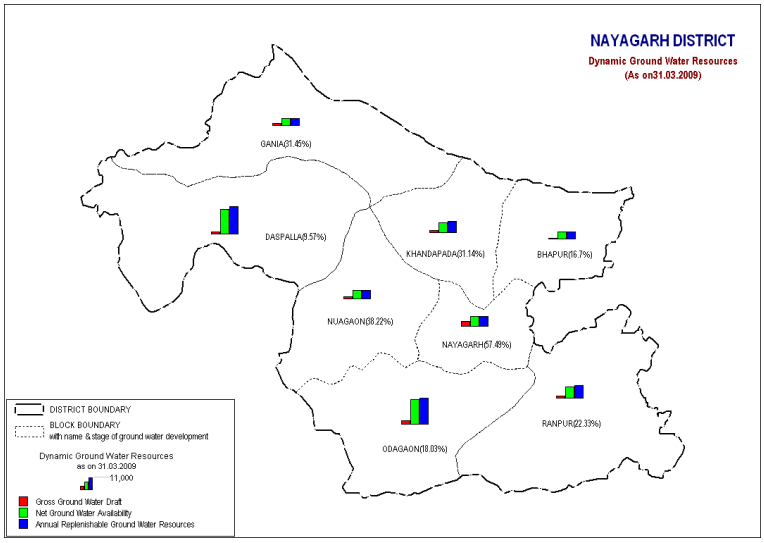
MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

OF

NAYAGARH DISTRICT



South Eastern Region

Bhubaneswar

May , 2013

District at a glance

SL. NO	ITEMS	STATISTICS
1.	**GENERAL INFORMATION**	
	a) Geographical area (Sq.Km)	3,890
	b) Administrative Division Number of Tehsil/Block Number of GramPanchayats(G.P)/villages	 4 Tehsils/8 Blocks 179 G.Ps, 1695 villages
	c) Population (As on 2011 census)	9,62,215
2.	**GEOMORPHOLOGY**	
	Major physiographic units	Structural Hills, Denudational Hills, Residual Hills, Lateritic uplands, Alluvial plains, Intermontane Valleys
	Major Drainages	The Mahanadi, Burtanga, Kaunria, Kamai & the Budha nadi
3.	**LAND USE (Sq. Km)**	
	a) Forest area:	2,080
	b) Net area sown:	1,310
4.	**MAJOR SOIL TYPES**	Alfisols, Ultisols
5.	**IRRIGATION BY DIFFERENT SOURCES (Areas and number of structures)**	
	Dug wells	14707 dug wells with Tenda, 783 with pumps
	Tube wells/ Bore wells	16 shallow tube wells, 123 filter point tube well
	Gross irrigated area	505.7 Sq.Km
6.	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.3.2007)**	16
	Number of Dug Wells	16
	Number of Piezometers	5
7.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Precambrian: Granite Gneiss, Khondalite, Charnockite Recent: Alluvium
9.	**HYDROGEOLOGY**	
	➢ Major water bearing formation ➢ Premonsoon depth to water level during 2006(mbgl)	Consolidated &Unconsolidated formations Min- 0.65 (Daspalla- I) Max- 9.48 (Khandapada)& Avg. 4.92l

	➢ Post-monsoon Depth to water level during 2006(mbgl) ➢ Long term water level trend in 10 yrs (1997-2007) in m/yr	Min –0.17 (Nayagarh), Max- 6.27 (Daspalla-II) & Avg.- 2.72 8 number of NHS shows rising trend from 0.027m/yr to 0.199m/yr & 8 show falling trend from 0.006 to 0.106m/yr.
10.	**GROUND WATER EXPLORATION BY CGWB(AS ON 31.03.2007)**	
	No. of wells drilled(EW, OW, PZ, SH, Total)	14 (12 EW, 4 OW) & 7 Nos through outsourcing (Contractual Drilling, Phase-II)
	Depth Range (m)	56.40 to 200.8m
	Discharge (liter/second)	Negligible to 13.5
11.	**GROUND WATER QUALITY**	
	Presence of chemical constituents more than permissible limit (e.g. E.C, F, As, Fe)	High Iron > 1mg/l at Daspalla-II (17 mg/l), Odogaon (4.9 mg/l) and Khandapada (1.3 mg/l) of Nayagarh District.
12.	**DYNAMIC GROUND WATER RESOURCES (2009) IN MCM**	
	Annual replenishable ground water resources	514.30
	Net annual ground Water Draft	79.80
	Projected demand for Domestic and Industrial uses up to 2025	24.18
	Stage of Ground Water development	15.52%
13.	**AWARENESS AND TRAINING ACTIVITY**	
	Date Place No.of Participants	NIL
14.	**EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING**	
	Projects completed by CGWB (No. & Amount spent)	NIL
	Projects under technical guidance of CGWB (Numbers)	NIL

15.	**GROUND WATER CONTROL AND REGULATION**	
	Number of OE blocks	Nil
	Number of Critical blocks	Nil
	Number of blocks notified	Nil
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	No major ground water problem in the district.

1.0 INTRODUCTION:

Nayagarh district with an area of 3890 Sq Km is bounded between latitudes 19^0 53' 52" N and $20^0$34' 46" N and longitudes 84^0 29' 26" E and 85^0 27' 22" E and falls in the SOI toposheets No. 73 D, H, E & A in 1: 2,50,000 scale. It is bounded by Boudh district in the west, Cuttack & Angul district in the north, Khurda district in the east and Khurda and Ganjam district in the south. There are 8 community development blocks in the district with its headquarter at Nayagarh town. The Population of the district as per 2001 census is 8,64,000, which is 2.35% of the total population of the state. The male and female population of the district is 4,46,000 and 4,18,000 respectively. The density of the population is 222 per Sq. Km. The total literate person of the district is 5,30,000. The district head quarter is connected to all the block headquarters and important towns by all weather roads.

The Mahanadi, Burtanga, Kaunria, Kamai, Budha nadi constitute the major drainage system of the district. The drainage is mainly dendritic, radial & centripetal in nature. Hot springs have been reported at Tarabalo near the village Nilakantha prasad. At Tarabalo, the patches of warm water (mud pool) in an elevated area cover about 1,500 Sq.m through which hot water oozes out. The temperature is about 57 degree centigrade and has a feebly sulphorous odour. The discharge is found to be 0.3 lps.

About 38% of the total geographical area is cultivable. Only 13% of the total geographical area is irrigated. Agriculture is the main occupation of the people in the district. The principal crops grown in the district are paddy, maize, mung, biri, groundnut, til, mustard, linseed and sugarcane. Sugarcane is grown as a commercial crop in Bhapur, Gania, Khandapada, Nayagarh and Odogaon blocks.

The district had been covered through systematic hydrogeological surveys by shri A.D. Rao (1983-84 & 1984-85) and shri B.B. Basak (1985-86) scientist-B. Brief hydrogeological studies around Nayagarh were carried out by Sri S.N. Sar in course of short term water supply investigation for augmentation of ground water supply for sugarcane industries at Nayagarh.

2.0 CLIMATE & RAINFALL:

The climate is generally dry tropical. The maximum temperature raised up to 42^0C during summer and minimum temperature goes down to 10^0C during winter seasons. The actual rainfall & the normal rainfall of the district recorded are found to be 1750.7mm & 1449.1 mm respectively.

3.0 GEOMORPHOLOGICAL SET UP:

The different hydrogeomorphological units of the district have been briefly summarized below:

1. Structural Hills: Structural Hills occupy major portions of the district and are controlled by folding, faulting and incised by numerous criss-cross joints and fractures, which facilitate infiltration.

2. Residual Hills: Residual Hills are scattered in pediment zone. This unit has poor infiltration characteristics and it behaves as run off zones.
3. Denudational Hills: Denudational Hills have restricted occurrence and are mostly seen in Nuagaon, Nayagarh & Daspalla blocks. These generally act as run off zones
4. Lateritic uplands: Ground water potential in this zone is moderately good having moderate infiltration. These are mostly found in Ranapur & Nayagarh block.
5. Intermontane valleys: Intermontane valleys are mostly structurally controlled and are found in the mountainous Western & North Western track of the district. Springs are generally found in this region. Ground water is moderately good.
6. Surface water bodies: Surface water bodies represent reservoirs of medium & minor irrigation projects.
7. Valley fills: Valley fills are promising zones for ground water occurrence that behave mainly as ground water discharge zones.
8. Shallow Buried Pediments: Shallow buried pediments are found along the periphery of hills & hillocks. Ground water occurs at moderate to deeper levels.
9. Moderate Buried Pediments: The thickness of the weathered mantle generally varies from 5 to 15m in moderate buried pediments. Infiltration is moderately good.
10. Deep Buried Pediment: The thickness of the weathered mantle varies from 10-20m in deep buried pediment.
11. Alluvial plain: Alluvial plain is the most potential hydrogeomorphic unit. It occurs in the eastern part of the district along the courses of the Kusumi, Dahuka, Kamai rivers and constitutes the ground water discharge zones.
12. Lineaments: Lineaments are structurally weak features, which allow ground water to percolate to the deeper horizons forming potential aquifers.

Structures: The area is a part of Eastern Ghats orogenic province. The joints, fractures, foliations form the prominent conduits for ground water movement. The structures generally trend in NW-SW direction with a dip of 70^0 to 80^0 towards east.

Soil & Landuse:

There are two types of soil generally found in the district

1. Alfisols
2. Ultisols

Alfisols: It consists of a wide range of soils including mixed red and black soils, red earth, red loamy soils, red sandy soils, red gravelly soils and other alluvial soils. The red soils are light textured, usually devoid of lime concretions deficient in nitrogen, phosphate & organic matter. The PH of the soil varies from 6.5 to 7.3. These soils are suitable for cultivation of paddy and other crops.

Ultisols: These include laterite & lateritic soil, red and yellow soils. They are characterized by low contents of Nitrogen, Phosphate, Potassium & Organic matter. The PH of the soils ranges from 4.5 to 6.0. Due to granular nature of these soils cultivation is possible immediately after heavy rains without the danger of any unsatisfactory physical state. This soil type is mainly encountered in the southern part of the district.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY:

The varied geological and structural set up primarily controls the hydrogeological condition of the district. The geological formations of the district have diverse lithological composition and structure. Depending upon geology, water bearing and water yielding properties, two major Hydrogeological units have been identified in the district.

1. Consolidated formations and
2. Unconsolidated formations.

Consolidated formation comprises mostly of the crystalline rocks devoid of primary porosity. Ground water occurs mainly in the weathered zone as also in the weaker zones such as joints, shears, foliation planes and fractures etc. In unconsolidated formations, ground water occurs in the inter-granular pore spaces. Rainfall and climate, topography, soil conditions and land use are the other factors controlling ground water potentials of the area.

Consolidated Formations:

Except for a few thin alluvial patches occurring as small strips along major rivers, almost the entire district is occupied by the consolidated formations comprising Granite Gneisses, Khondalites, Charnockites, etc. These rocks are very hard and compact and lack primary porosity. Ground water is stored mainly in the secondary porosity resulting from weathering and fracturing of the rocks. The aquifer materials are highly heterogeneous in character showing both vertical and lateral variations depending on the extent and nature of weathering and degree of fracturing and jointing. The weathered residuum form the main repository of ground water, in which ground water occurs under water table condition and circulates through deeper fractures, crevices, open joints and fissures.

Water Bearing Properties of Major Litho Units:

Granite Gneisses. Granitic rocks are seen to form structural, residual and denudational hills. These are the most predominant rock type in the district comprising porphyritic granite gneiss, garnetiferous granite gneiss, biotite granite gneiss and granite gneiss etc. These are light grey to grey in colour, fine to coarse grained and composed of quartz, felspar, biotite, garnet etc. Phenocrysts of feldspar are common in the porphyritic granite gneiss. Granite gneisses exhibit wide variations in texture and composition due to different cycles of igneous activities and

different grades of metamorphism. The granitic rocks exhibit well-developed foliation but at places are compact and massive. In a few places the granite gneisses are intruded by dolerite dykes and intersected by veins of pegmatite and quartz. The granitic rocks are highly weathered, well jointed with considerably wider openings. The thickness of the weathered residuum is generally found to vary from 5 to 15m. The depth to water level varies form 0.85m to 10.03m below ground level during pre monsoon period and 0.16m to 6.27m during post monsoon period. The yield of dug wells in this formation is found to be around 3 lps and that of bore wells and dug-cum bore wells is 5 lps under favorable hydrogeological conditions.

Charnockite suite: The Charnockite suite of rocks has limited extent, generally exposed in the western parts of the district. The Charnockite suite of rocks consists mainly of hypersthene bearing rocks varying from acid to basic in composition. Main rock types are hypersthene granite, pyroxene, amphibolite, andalusite gneisses etc. These are greenish gray to brownish black in colour. Charnockite exhibits intrusive relationship with the Khondalites and forms hybrid gneisses both with the Khondalites and other ancient gneisses. Spheroidal weathering is a common feature noticeable in Charnockite areas. However, weathering is not pronounced and foliations and joints are not well developed in them. The thickness of weathered residuum varies from 5 to 10 m. Dug wells are the common ground water structures in this unit. The yield may vary up to 3 lps.

Khondalite suite: the Khondalite suite of rocks consists mainly of quartz-garnet-sillimanite- graphite schists and gneisses, garnetiferous quartzite and calc silicate rocks, which generally form steep hills. This suite of rocks is less dominant in the area than granitic suite of rocks. Khondalites are mainly exposed in the eastern and southeastern tracks of the district. Joints and fractures are moderately well developed in Khondalites. The yield of dug wells generally ranges up to 3 lps. Dug cum bore wells in this region may yield up to 5 lps under favorable geological conditions.

Pegmatites and Quartz veins: These are found intruding the country rocks along the fracture plains. These rocks are coarse grained, comprising mainly of quartz, feldspar and mica.

Unconsolidated Formation:

Laterites belonging to the Pleistocene age and alluvium of Sub-recent to Recent age constitute the unconsolidated formations in the district.

Laterite and Lateritic Gravels: These occur as thin and discontinuous patches capping over the older formations. The thickness of Laterite usually varies from 3 to 15 m. These are generally found in the southeastern and eastern part of the district.

Alluvium and Valley fills: The alluvium comprises of sand silt clay layers of varying thickness and occurs as channel fills along the courses of the Duanta Dahuka, Kusumi, Kaunria & Burtunga. The alluvial strips along the river courses constitute

the most potential aquifers in the district due to their high porosity and permeability. The thickness of alluvium varies down to a depth of 45 m. The depth to water level varies from 1.19m to 3.85 m bgl in pre monsoon and 0.11m to 1.30 m bgl in post monsoon periods. The yield of this formation varies from 6 lps to 15 lps.

Depth to water level: The phreatic zone constitutes the most potential ground water reservoir in the district. This zone has been mapped in course of hydro geological surveys. With a view to ascertain the changes in the ground water regime and make an over all assessment of the ground water resources CGWB has, so far, established 16 network hydrograph stations through out the district which are monitored manually 4 times in a year, during January, April, August and November. The depth to water table values depend on several factors like rainfall, topography, drainage characteristics, proximity to drainage channels, lithology, water bearing and water yielding properties of the rocks, as also land use.

The average depth to water level in m bgl of hydrograph network stations in Nayagarh district for the period 2001-2011

Location	Well No	January	April	August	November
Banigocha	73D-3C1	6.38	7.62	3.85	4.33
Daspalla-i	73D-3D1	-	0.90	0.80	0.30
Daspalla-ii	73D-3D3	4.95	7.05	4.63	6.01
Gania	73H-3A3	3.29	4.92	2.96	3.84
Kandapara	73H-3A4	7.58	11.02	5.53	5.79
Kantilo	73H-3A6	1.14	1.64	0.29	0.99
Mahipur	73D-4D3	3.32	4.26	1.75	2.31
Nayagarh	73H-4A1	0.97	1.53	0.05	0.34
Nuagaon	73D-3D2	3.59	3.95	2.79	3.32
Odogaon	73D-4D1	4.66	6.79	1.91	3.42
Purusottampur	73H-4A2	2.89	5.13	1.40	1.75
Ranpur	73H-4B2	3.96	6.58	2.68	3.50
Sarankul	73H-4A3	3.09	4.47	1.43	2.30
Subalaya	73D-3D4	4.01	5.84	0.58	1.54
Takara	73D-3C2A	6.41	7.52	3.08	4.87

A perusal of the data indicates that the average depth to water level in the district ranges from 0.9 m below ground level (at Daspalla -i) to 11.02 m below ground level (at Khandapada) during pre-monsoon period and from 0.30 m below ground level (at Daspalla-i) to 6.01 m below ground level (at Khandapada) during post monsoon period respectively. In the year 2011 the range of water level in the hydrograph stations was between 0.65 and 9.48 m below ground level during the pre monsoon period (April 2011) and between ground level to 6.27 m below ground level during the post monsoon period (November 2011). The water table is shallow in most part of the district. The pre-monsoon depth to water level values are generally

in the range of 5m to 10m (in about 50% of the wells) in most part of the area, about 31% of the wells showing depth to water level between 2m and 5m and about 18% of the wells showing depth to water level less than 2m.

Seasonal Fluctuations

A perusal of the categorization of change in water level of 2011 pre monsoon with respect to the mean of last 10 years of data from 2001 to 2011 `reveals that 11 Nos of well (73.3% of the total NHS) show rising trend in the depth range of 0-2 m bgl. 1 no of wells (6.7% of the wells) shows water level in the depth range of 2-4m bgl. 3 Nos of wells (20%of the well) shows falling trend in the depth range of 0-2m bgl. The post monsoon seasonal fluctuation of the data shows rising trend in 7 Nos of wells (46.7% of the well) in the depth range of 0-2 m bgl and 1 no of wells show rising trend in the depth range of 2-4 m bgl. The falling trend in 7 nos of wells is recorded in the depth range of 0-2m. The pre monsoon and post monsoon water level data with the decadal mean shows that there is no appreciable change in the ground water regime. Trend Analysis of the Hydrograph Stations also supports this phenomenon except those in the canal command areas where the stations show a perceptible rising trend during the pre monsoon period probably due to the release of canal water during this period.

Water level trend

The decadal water level trends during pre-monsoon period indicate that 66.7 percent stations show rising trend of water level, the maximum being 0.199 m/Yr. The falling trend of water level is shown by about 37 % of the stations and maximum fall recorded is 0.105 m/yr.

The decadal water level trend analysis data of post-monsoon indicate that there is a rising trend of water level in 53.4% cases and falling trend in rest 46.7% cases. The maximum rise recorded is 0.231 m/yr with the majority of the values being less than 0.10 m/yr. The maximum fall is around 0.083/yr with the majority of the values being less than 0.1m/yr.

4.2 GROUND WATER RESOURCES

The principal source of recharge to ground water are rainfall, seepage from canals, return flow from applied irrigation, seepage from tanks and ponds. Ground water exploitation for domestic use in the district is mainly through private dug wells and hand pump fitted government bore wells. Data pertaining to various parameters such as rainfall, water level fluctuation, specific yield, ground water abstraction structures for various utilities, irrigation and other data recorded and / or collected by CGWB, SE region and GWS & I, Government of Orissa and other state government agencies have been utilized to estimate the dynamic ground water resource of Nayagarh district. Block wise availability of ground water resources has been

estimated, based on norms recommended by Ground Water Estimation Committee (G.E.C. 1997). The total annual dynamic ground water resource of Nayagarh district is assessed to be 42,682 hectare metre. The annual utilizable ground water resource earmarked for domestic and industrial use is 2,017 hectare metre which is based on the projection of requirement by the year 2025. The gross annual draft for all uses is 9446 hectare metre leaving a balance ground water resource of 32820 hectare metre for further development for irrigation use. The present average stage of groundwater development in the district has been worked out to be only 22.13 %. The stage of ground water development varies from a maximum of 57.49 % in Nayagarh block to a minimum of 9.57 % in Daspalla block.

Ground water Resource Potential of Nayagarh District As on 31.03.2009

Figures in hectare metre

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	Bhapur	2946	281	211	492	266	2399	16.70
2	Daspalla	10051	750	211	962	264	9037	9.57
3	Gania	2817	806	80	886	96	1915	31.45
4	Khandapada	4203	1045	264	1309	327	2831	31.14
5	Nayagarh	3783	1821	353	2175	414	1548	57.49
6	Nuagaon	4377	603	198	801	232	3542	18.30
7	Odogaon	9726	1401	353	1754	427	7898	18.03
8	Ranapur	4779	722	345	1067	425	3632	22.33
	Total	42682	7429	2017	9446	2451	32802	22.13

4.3 GROUND WATER QUALITY

Quality of ground water is an important factor for assessing its suitability for various uses. Ground water quality depends upon the lithological and chemical composition of the aquifer, climatic conditions, quantum of recharge made and its movement, activities of microorganisms, temperature and presence of contaminants in the environment. The specific conductance value in the district generally ranges from 500 to 1000 micro mhos/cm at 25^0C but values of the order of 1500 to 2600 micro mhos/cm have also been noted near Odogaon in the east near Nayagarh and in the villages located in Burtang nadi valley north of Daspalla. The concentration of chloride generally ranges from 50 to 100 mg/l. However at places where the specific conductance values are high, the chloride content also is relatively high up to 300 mg/l.

High fluoride in ground water (> 1.5 mg/l) may cause crippling skeletal fluorosis. High fluoride is retained mainly in the skeletal and a small portion in teeth. High fluoride concentration is found at Nuagaon of Nayagarh district. High concentration of Iron in ground water gives bittersweet astringent taste and making it aesthetically undesirable in colour, odour and turbidity. Intake of high dose of Iron present in ground water may result in Haemochromotosis i.e. accumulation of Iron in kidneys, lungs, liver etc. resulting in stone formation and malfunctioning of these organs. The concentration of Iron more than permissible limit (> 1.0 mg/l as per BIS :10500) have been recorded in wells of Daspalla-II (17mg/l), Odagaon (4.9 mg/l) and Khandapada(1.3mg/l) of Nayagarh District.

4.4 STATUS OF GROUND WATER DEVELOPMENT

A total of 12 exploratory and 4 observation wells were drilled in the district. The depth of these wells varied from 56.4m to 200.8m and the yield varied from negligible to 13.5 lps. One to three sets of saturated fractures were encountered and in the majority of the cases fractures were found to be restricted within 100m depths. The deeper (>100m) saturated fractures are mostly found to be low yielding. The static water levels vary from 2.26 to 5.40m bgl. The drawdowns are generally restricted within 20m. The moderately high discharge wells are located at Madhekhand (4 lps), Gania (3.5 lps), Kantilo (7.2 lps), Khedpara (5.25 lps). A high yielding well is located at Bhapur (13.5 lps). It is noted that in the northern part of the district along Madhekhand-Gania-Kantilo-Bhapur area, potential saturated fractures occur. In other parts of the district the yield is generally low.

5.0 GROUND WATER MANAGEMENT STRATEGIES

5.1 GROUND WATER DEVELOPMENT

Ground water development in the district is mainly through dug wells, Dug-cum-bore wells and bore wells. Ground water is mainly used for domestic and irrigation purpose and in a limited scale for industrial purpose. The present average stage of groundwater development in the district is only 15.52% having a vast scope for further ground water development for irrigation purpose. Poor infrastructure facilities, fragmented land holdings coupled with traditional cropping pattern, unreliable power supply, non availability of diesel in remote areas are some of the constraints in non viability of individual investment in ground water sector and speedy and optimal development of ground water in the district. In fact, as per the estimate, 42930 hectare meter balance ground water resource remains to be utilized for irrigation purpose.

In Nayagarh district 14707 numbers of dug wells with tenda, 783 numbers of dug wells fitted with pumps, 16 numbers of shallow tube wells, 123 numbers of filter point tube wells are in operation.

Dug wells are the most common ground water abstraction structures in the district. Dugwells are feasible in the buried pediment areas, valley fills and flood plains,

underlain by the crystalline formations. The design of the dug well is dependent on the irrigation water requirement of the crops, depth to water level, thickness of the saturated zone and seasonal water level fluctuation. The depth of the dug wells may vary from 10-15m and the diameter may range from 4.5m to 6m.

Dug-cum-bore wells are essentially dug wells with a vertical bore through the bottom drilled down to a depth of 25 to 30m below ground level, tapping the saturated shallow fracture zones. The wells should be fitted with 2 H.P centrifugal/ submersible pumps. Such structures are feasible in the pediment areas of the district.

Shallow filter point tubes well are feasible in the alluvial track of Kusumi and Dahuka rivers. The wells may be drilled down to 45 m depth and the diameter will be 100 to 150 mm. The wells should be fitted with 3 to 5 H.P submersible pumps. Tentatively a total of 40-filter point tube wells and 15 shallow tube wells may be drilled in the district.

Bore wells may tap the deeper saturated fractures found to occur in the depth range of100 to 120m. The bore wells should be of 100 to 150mm diameter and may be fitted with submersible pumps of 2 H.P capacities.

Studies based on hydrogeological, hydrological, meteorological, geophysical, remote sensing and other parameters like cropping intensity, cropping pattern etc should be taken up in the canal command areas and suitable methods for better management of surface and ground water should be devised. Suitable ground water development plan should be brought out through ground water flow modeling. Water logging problem can be avoided through conjunctive use of surface water and ground water. The demand of water for 200% cropping intensity can be met from surface water and ground water in suitable and optimal proportions for both the seasons. The existing cropping pattern may be modified wherever necessary. Diversification of crops from paddy to non-paddy crops like oil seed, pulses, vegetables during rabi season, at least in the high land and in parts of medium land areas is essential. Conjunctive use of surface water and ground water can rectify water logging condition, augment irrigation potentials and ensure safe agricultural practices in periods of delayed monsoon rainfall.

5.2 GROUND WATER CONSERVATION AND ARTIFICIAL RECHARGE:

Some parts of the district show deeper water level condition during the post monsoon period. This is mainly due to the prevailing topographic conditions and water table gradient, which facilitates flow of ground water through nalas, rivers and streams as base flows. To arrest the rapid decline of water table in these areas special studies may be taken up to pin point the areas where water scarcity problems are more pronounced during pre-monsoon period. In these pockets suitable sites are required to be pin pointed to adopt artificial recharge techniques

and rain water-harvesting methods based on site-specific conditions. This artificial recharge will help in increase of ground water storage and also in improving the quality of ground water. The most feasible artificial recharge and rain water harvesting structures are percolation tanks, nala/contour bunding, small check dams/weirs, renovation of old tanks to percolation tanks, water spreading, gully plugging, gabion structures etc.

Suitable Rain water Harvesting and Artificial Recharge Techniques may be adopted where fluoride concentration is more than permissible limit. The suitable areas identified for ground water conservation and artificial recharge is shown in the ground water development possibility map of the district.

6.0 GROUND WATER RELATED ISSUES & PROBLEMS:

The concentration of Iron more than permissible limit (> 1.0 mg/l as per BIS 10500) have been recorded in wells of Daspalla-II(17 mg/l), Odagaon (4.9 mg/l) and Khandapada(1.3 mg/l) of Nayagarh District. High fluoride concentration is found at Nuagaon of Nayagarh district.

The analysis of water level trend over the years (last 10 years) for both pre-monsoon and post monsoon periods indicates that there is no appreciable change in water levels. This indicates that no depletion of water level has taken place in the district.

7.0 AWARENESS & TRAINING ACTIVITY

7.1 MASS AWARENESS PROGRAMME (MAP) & WATER MANAGEMENT TRAINING PROGRAMME (WMTP) BY CGWB

No Mass Awareness programme (MAP) & Water Management Training programme (WMTP) by CGWB have been conducted in the district.

7.2 PARTICIPATION IN EXHIBITION, MELA, FAIR ETC

CGWB has not participated in any exhibition, mela or fair in the districts in the recent past.

8.0 AREAS NOTIFIED BY CGWA/SGWA

None of the areas of the district has been declared notified by CGWA or SGWA.

RECCOMMENDATIONS

1) As there is large scope for development of ground water, suitable schemes may be launched for ground water development to boost agricultural

production in the district. The financial institutions should generously finance such schemes.

2) In construction of ground water abstraction structures, such as dug wells, dug cum bore wells and bore wells, for irrigation minimum safe spacing should be maintained to avoid interference of the wells.

3) For optimum utilization of the groundwater potential, necessary steps should be taken for engrisation of the wells.

4) The yield of existing dug wells may be enhanced by converting those into dug cum bore wells wherever feasible and the wells should be provided with brick lining which will facilitate the free flow of ground water into the well.

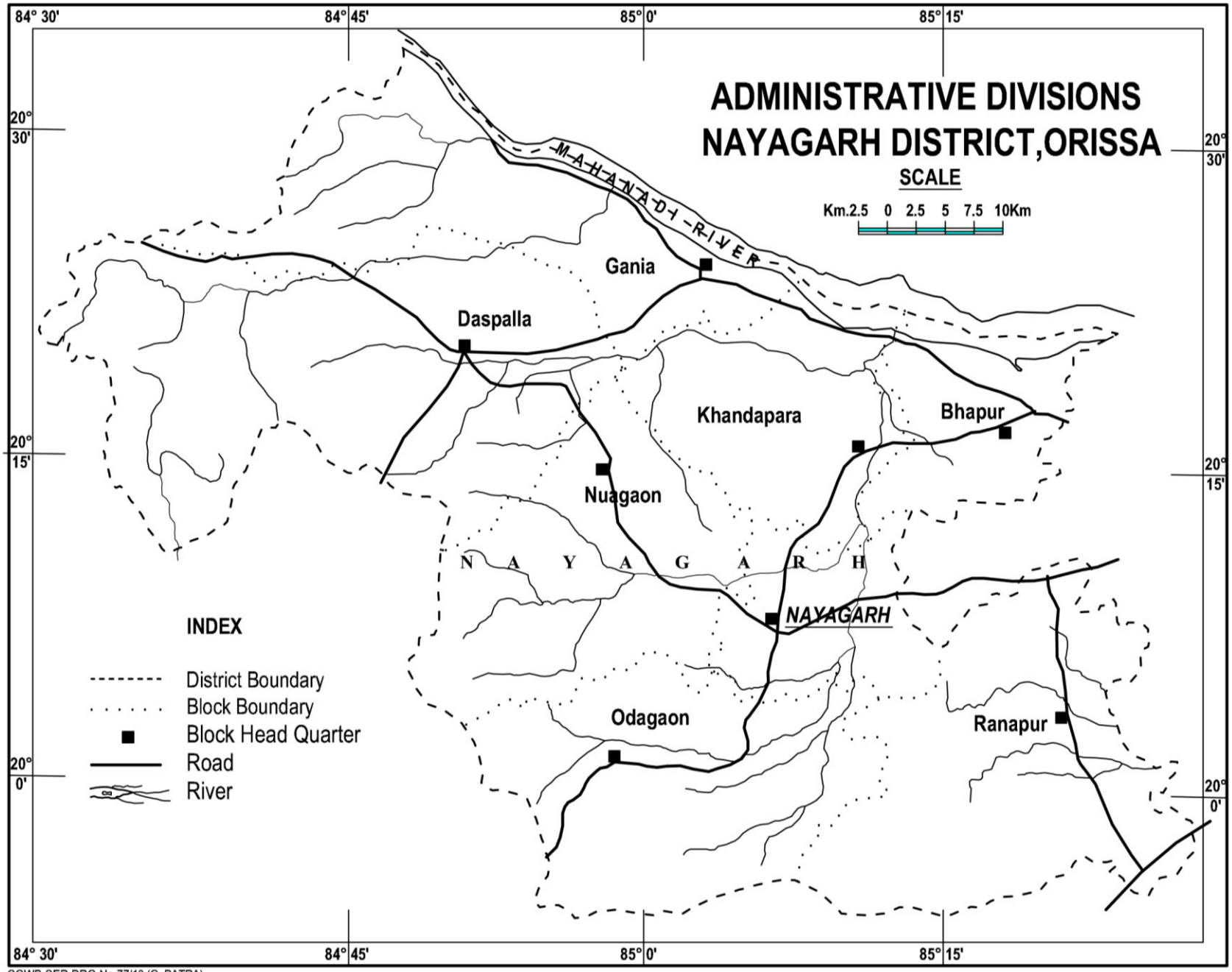
5) Detailed surface geophysical survey aided by photogeological & remote-sensing studies may be taken up in the district to identify the exact thickness of weathered zone and occurrence and extent of lineaments, which form potential aquifer zones.

6) The agricultural extension services should motivate and guide the farmers to adopt suitable cropping patterns to maximize the benefits of irrigation through dug wells / bore wells.

7) Construction of check dams, nalla bunds, percolation tanks at suitable locations will help in effecting additional recharge to the ground water reservoir. Sub-surface dams may also be constructed at hydrogeologically suitable sites to arrest sub-surface out flow of ground water in the weathered mantle of hard massive rocks. This will increase the dynamic ground water storage in the adjacent phreatic aquifer.

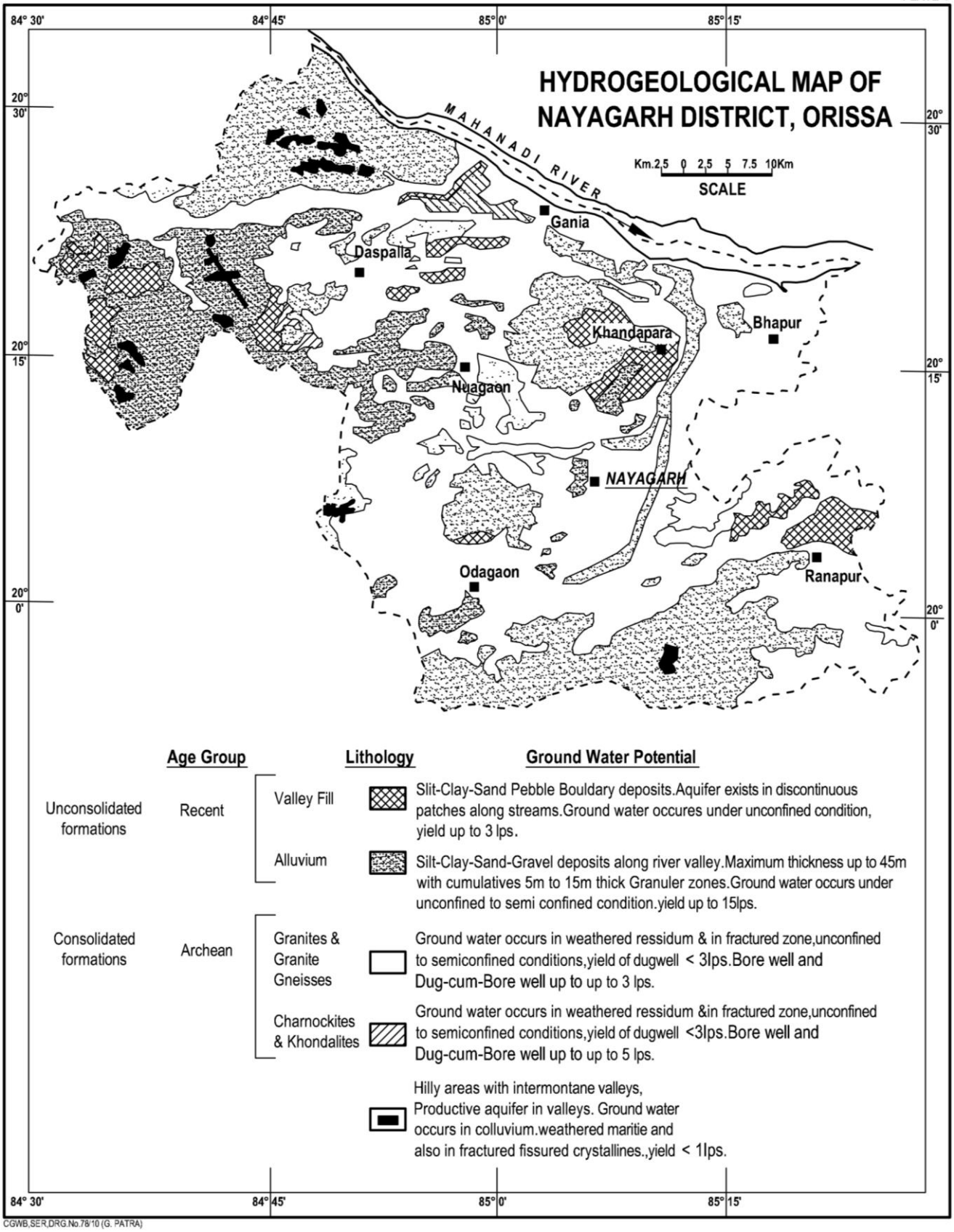
8) Ground water monitoring in the district, for water level and water quality, through National Hydrograph Stations should be strengthened to assess the impact of envisaged ground water development on the ground water regime and to find out the status of water logging in the canal command areas.

PLATE-I



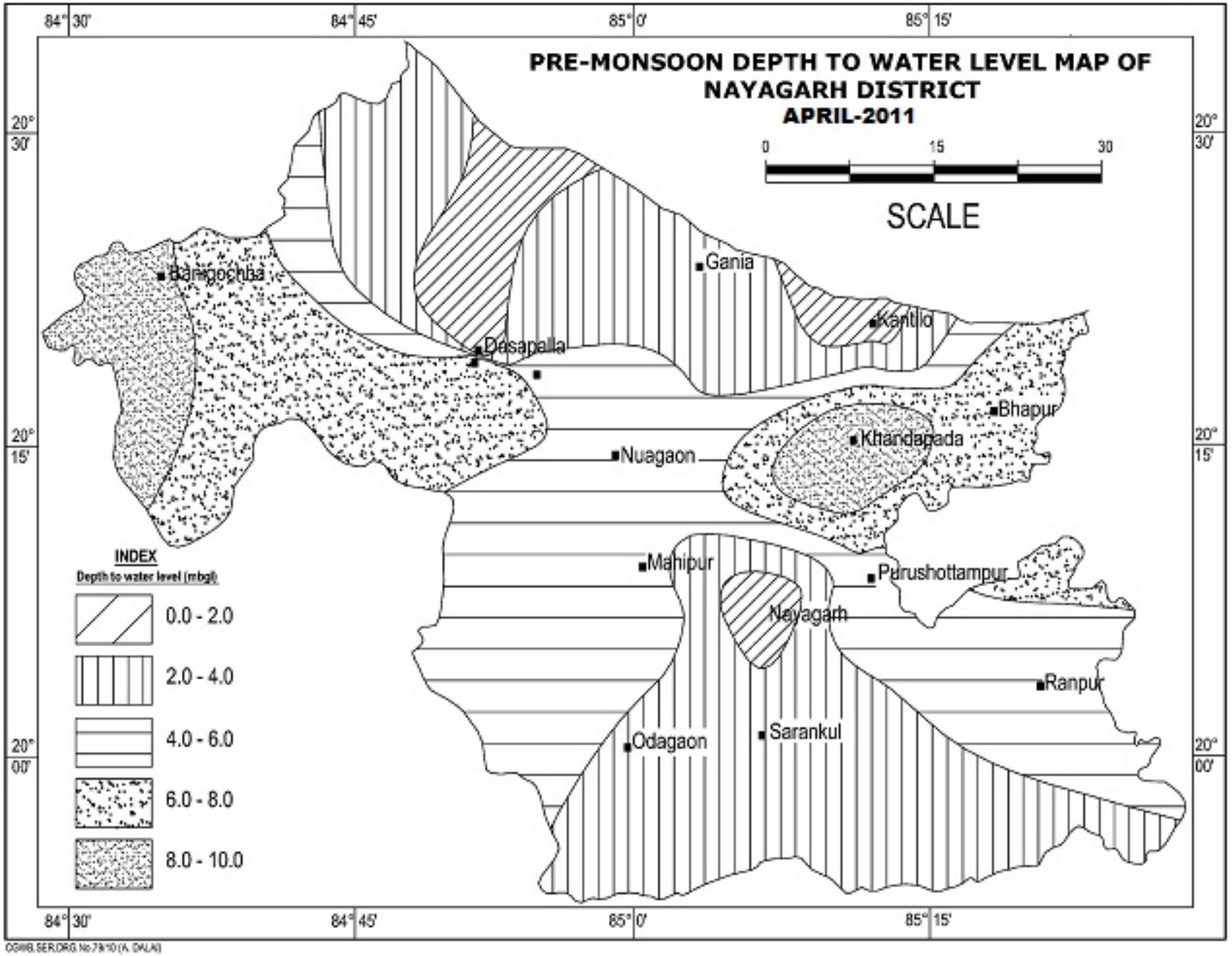
CGWB,SER,DRG.No.77/10 (G. PATRA)

PLATE-4



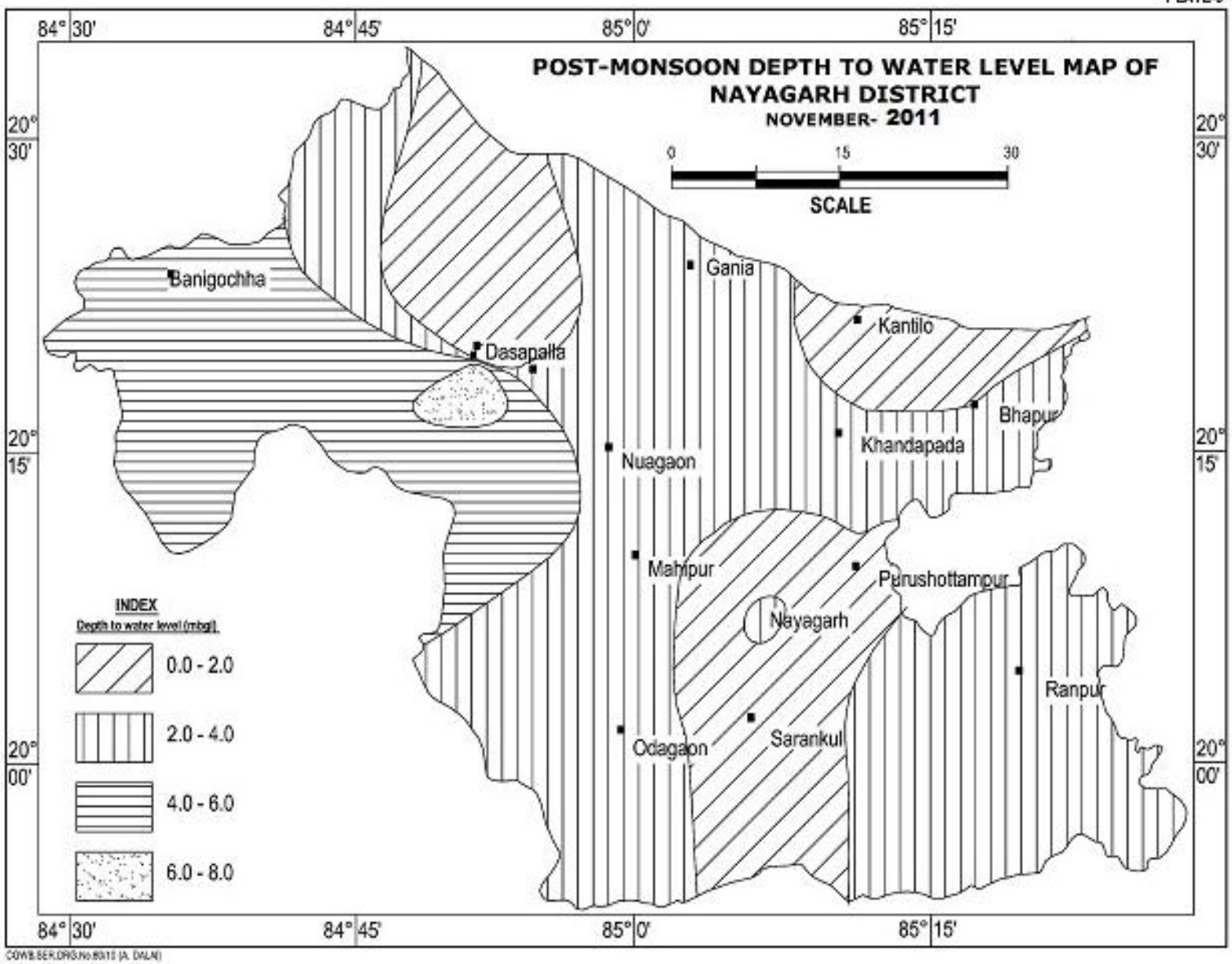
CGWB,SER,DRG.No.78/10 (G. PATRA)

PLATE-2

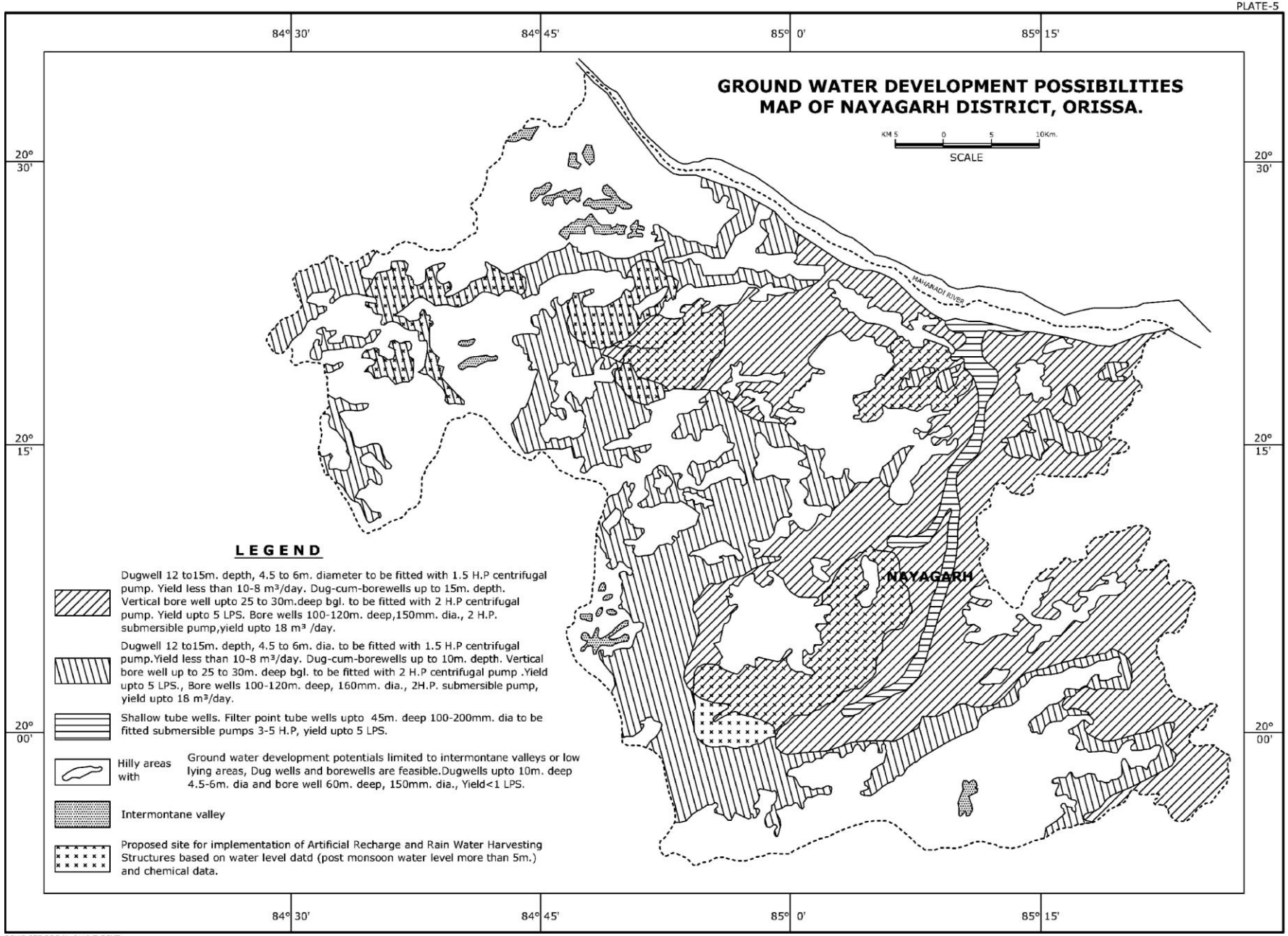


CGWB,SER,ORG No.79/10 (A. DALAI)

PLATE-3

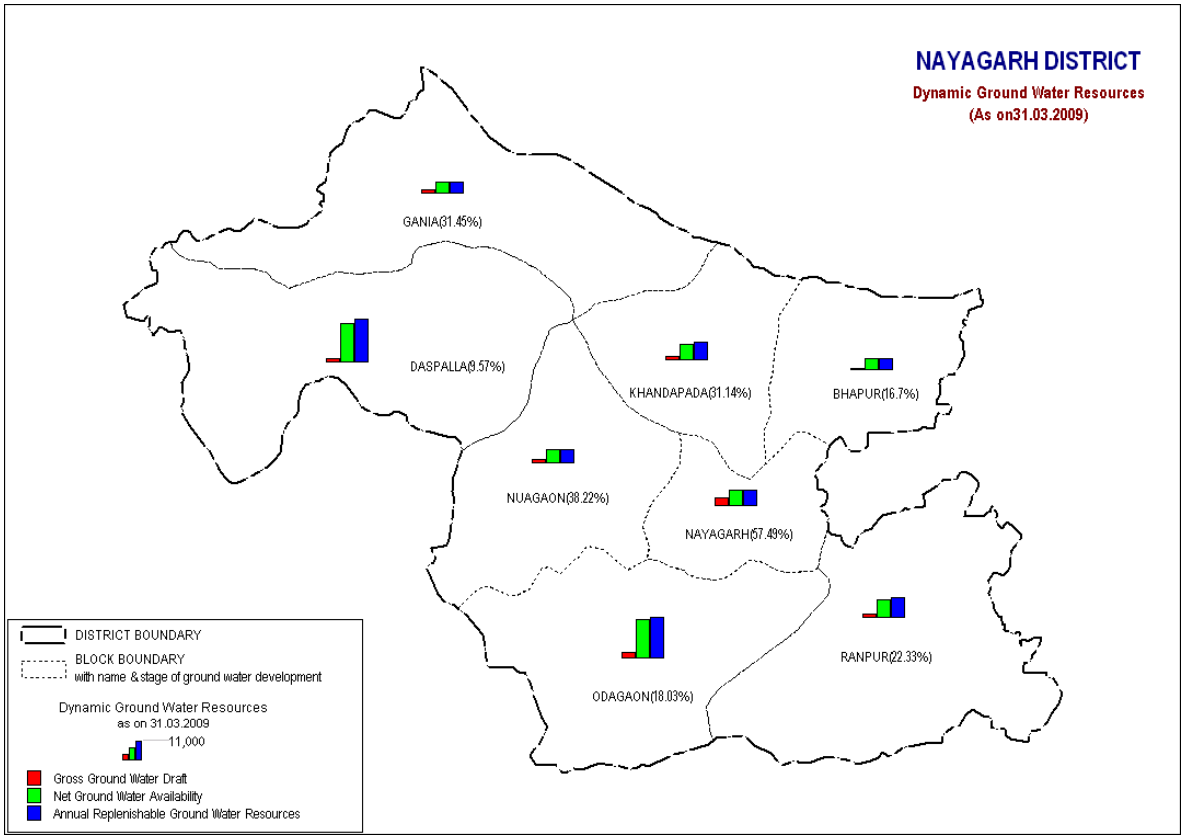


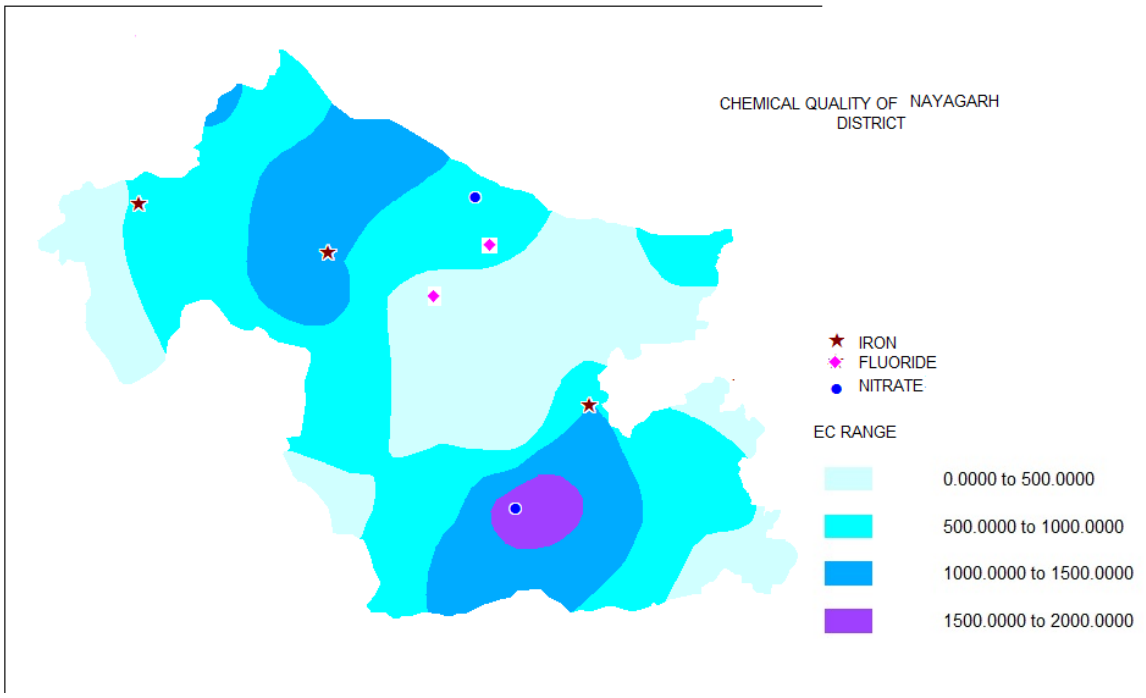
CGWB,SER,ORS/No.80/13 (A. DALAI)



CGWB,SER,DRG.No.81/10 (R.ROUT)

Plate -6


NAYAGARH DISTRICT
Dynamic Ground Water Resources
(As on31.03.2009)
GANIA(31.45%)
DASPALLA(8.57%)
KHANDAPADA(31.14%)
BHAPUR(16.7%)
NUAGAON(38.22%)
NAYAGARH(57.49%)
RANPUR(22.33%)
ODAGAON(18.03%)
DISTRICT BOUNDARY
BLOCK BOUNDARY
with name & stage of ground water development
Dynamic Ground Water Resources
as on 31.03.2009
11,000
Gross Ground Water Draft
Net Ground Water Availability
Annual Replenishable Ground Water Resources


CHEMICAL QUALITY OF NAYAGARH DISTRICT
IRON
FLUORIDE
NITRATE
EC RANGE
0.0000 to 500.0000
500.0000 to 1000.0000
1000.0000 to 1500.0000
1500.0000 to 2000.0000