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Government of India
Ministry of Water Resources
Central Ground Water Board

**GROUND WATER BROCHURE OF BASTAR DISTRICT
CHHATTISGARH
2012-13**



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GROUND WATER BROCHURE OF BASTAR DISTRICT DISTRICT AT A GLANCE

I Location

- | | |
|-------------|---|
| 1. Location | : Located in the SSE part of Chhattisgarh State |
| Latitude | : 18°38'04"- 20°11'40" N |
| Longitude | : 81°17'35"- 82°14'50" E |

II General

- | | |
|-----------------------------|---|
| 1. Geographical area | : 10577.7 sq.km |
| 2. Villages | : 1087 nos |
| 3. Development blocks | : 12 nos |
| 4. Population | : 1411644 |
| Male | : 697359 |
| Female | : 714285 |
| 5. Average annual rainfall | : 1386.77mm |
| 6. Major Physiographic unit | : Predominantly Bastar plateau |
| 7. Major Drainage | : Indravati , Kotri and Narangi rivers |
| 8. Forest area | : 1997.68 sq. km (Reserved)
390.38 sq. km (Protected)
2588.75 sq. km (Revenue)
Total – 4976.77 sq.km. |

III Major Soil

- | | |
|-------------|---------------------------------------|
| 1) Alfisols | : Red gravelly, red sandy & red loamy |
| 2) Ultisols | : Lateritic, Red & yellow soil |

IV Principal crops

- | | |
|----------|-----------|
| 1) Rice | : 2024 ha |
| 2) Wheat | : 667ha |
| 3) Maize | : 2250 ha |

V Irrigation

- | | |
|---------------------------------|--------------------|
| 1) Net area sown | : 315657 sq. km |
| 2) Net and gross irrigated area | : 9592 ha |
| a) By dug wells | : 2460 no (758 ha) |
| b) By tube wells | : 1973 no (2184ha) |
| c) By tank/Ponds | : 102 no (1442ha) |
| d) By canals | : 15 no (421 ha) |
| e) By other sources | : 4391 ha |

VI Monitoring wells (by CGWB)

- | | |
|----------------|---------|
| 1) Dug wells | : 28 no |
| 2) Piezometers | : 09 no |

VII Geology

: Bengpal and Dongargarh group (granites and gneisses) Abujhmar

sedimentaries and Volcanics ,
arenaceous, Calcareous
and Argillaceous rocks of
Indravati Group

VIII Hydrogeology

- 1) Water bearing formation : Weathered & fractured
Granites
and Gneisses, Fractured
shales,
Cavernous Limestone and
Dolomite
- 2) Water level
- a) Pre monsoon water level depth (2006) : 1.70m to 10.37 mbgl
b) Post monsoon water level depth : 0.43m to 4.08 mbgl
c) Water level trend (1997-2006) : No significant rise and fall

IX. Ground water exploration (By CGWB)

- 1) Wells drilled : 63 no
- a) Exploration : 52no
b) Observation : 11 no
c) Piezometer : 12 no
- 2) Depth range : 20 to 160 m
- 3) Discharge : 0.5 to 40 lps
- 4) Transmissivity : 17 to 219 m²/day
(For Granites)
5 to 395 m²/day(For
Limestone and Dolomite)

X Ground water quality : Useful for all purposes

XI Ground water resources(2009)

- 1) Annual available resource : 115639.21 ham
2) Annual available resource : 109857.24 ha.m
3) Ground water draft : 11667.17 ha.m
4) Available resource for future use : 97847.75 ham
5) Stage of ground water development : 10.62 %

XII Awareness and training activity : MAP at Jagdalpur (04-05)
: Training at Jagdalpur (05-06)

XIII Artificial recharge and rain water harvesting

- 1) Projects by CGWB : Nil
2) Projects under technical guidance : Nil

XIV Ground water control and regulation : Nil (No over exploited,
critical and notified areas)

XV Major ground water problems and issues : Nil

Ground Water Brochure of Bastar District, Chhattisgarh

By

K.B.N.Soni, Assistant Hydrogeologist

1. General

The Bastar district covers an area of 10577.7 sq. km. It consists of 1087 no of villages. For administrative convenience these villages are grouped into 12 no of development blocks. Jagdalpur is the district headquarter. The block head quarters are Keshkal, Baderajpur, Pharasgaon, Makri, Kondagaon, Bastar, Bakawand, Lohandiguda, Tokapal, Bastanar, Darbha and Jagdalpur. The district is known for its forest produce and mineral wealth. **Fig.1** shows the location of the area along with the drainage, block head quarters, location of NHS and location of exploratory wells drilled in the district.

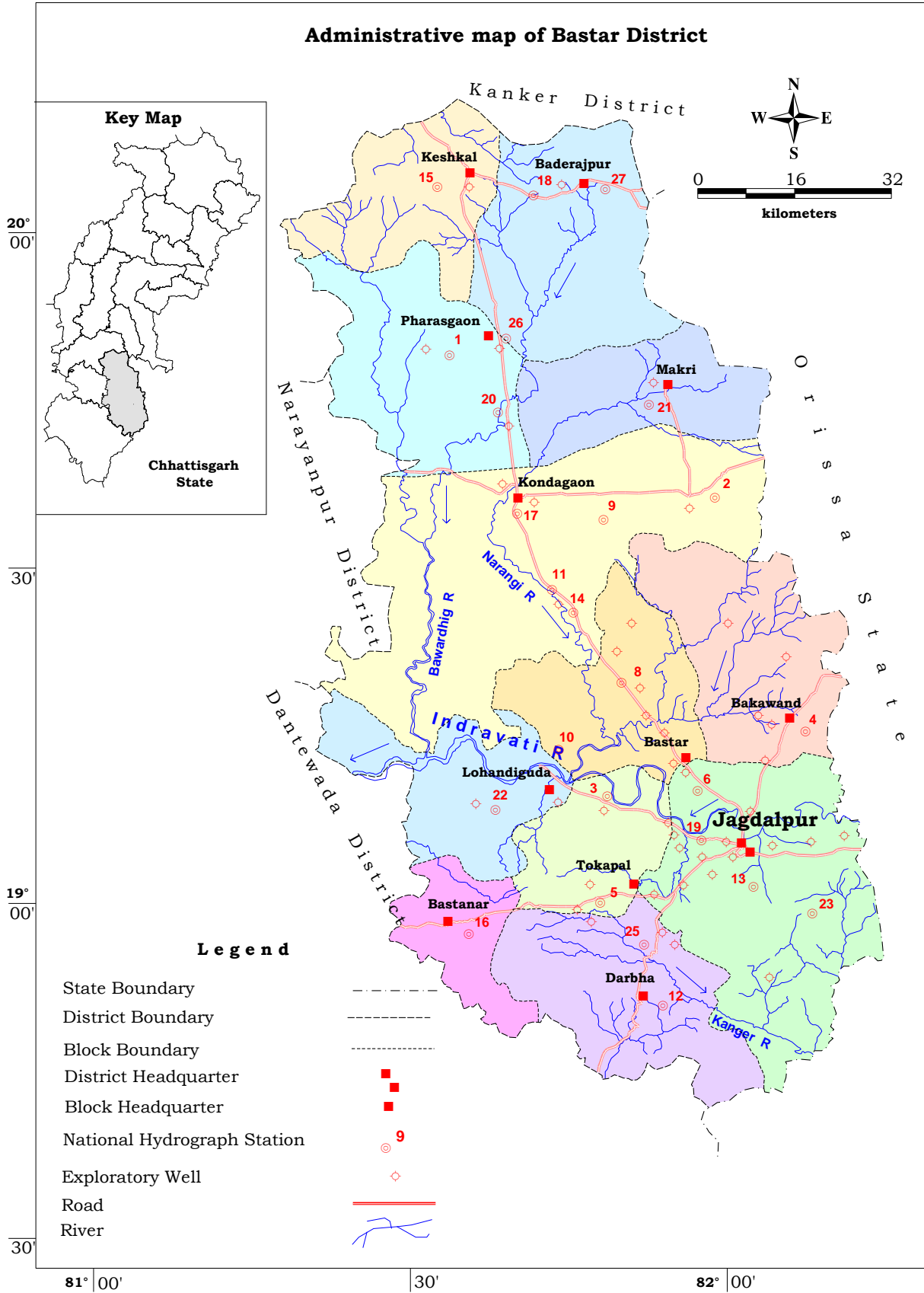
Nearly 97 % of the area is drained by Indravati River and Sabari River, which are tributary to Godavari River. The tributaries for Indravati are Kotri, Narangi, Nibra and Bavardhig whereas Kanger and Kolab are tributaries for Sabari. The remaining 3 % of the area is drained by Mahanadi River in the extreme northern part of the district with Hatkul tributary.

The normal annual rainfall for the district is 1386.77 mm. The annual temperature varies from 10.6°C in winter to 46°C in summer. The relative humidity varies from 90% in rainy season to 30-40% during winter.

Physiographically the district is predominantly a part of Bastar plateau. The maximum altitude is 956 m amsl and is near the village Ghatakala lying in the extreme western part of the district(in Abujmahar protected forest area)and the minimum altitude is 563 m amsl which is on the SSE part of the district near Pulsa village, existing near Kolab river. The average elevation is around 600 m amsl. The general slope is towards south and southwest in central part of the district and is towards south and south east in the southern part of the district. The northern part of the district, falling under Mahanadi River basin is having the slope towards north.

The soils in the district are having wide variations. Most of the area is covered by red gravelly, red sandy and loamy Alfisols. As most of the area is covered by crystallines and metamorphic rocks the soils derived by weathering are red soils.. At some places Ultisols in the form of laterites are also present. The trap rocks in the

Fig. - 1



district are occurring as hills rather than plateaus and consequently the trap slopes developed light soils rather than the deep black cotton soil.

2. Geology and Hydrogeology

Geologically the district is covered by metasediments and crystallines of Precambrians constituting Bengal, Bailadila, Dongargarh and Abujhamar group of rocks. The formations include Gneisses, Granites and matasediments, Basalt and Gabbroic rocks, acid and basic intrusives. The south eastern part of the district is covered by the arenaceous-argillaceous-calcareous sequence of sediments of Indravati Group. The ground water mainly occurs in phreatic (water table) conditions and at places under semi-confined conditions. In granites/gneisses the weathered thickness varies from 13 to 29 m. and the weathered and fractured formation constitute the aquifers. Invariably the fractures are limited to a depth of 21 to 142 m. In sedimentary formations the weathered thickness varies from 10.75 to 45 meters where as the fractured and cavernous formation constitute the aquifers. Invariably the fractures/caverns are limited to a depth of 67m . The hydrogeological map prepared for the district is presented in **Fig .6**.

In all 28 no of observation wells (National Hydrograph Network Stations) and 9 no piezometers were established in the district to monitor water levels 4 times a year and water quality once a year.

The pre-monsoon ground water level in the district (**Fig. 2**) varies from 1.70 to 10.37mbgl and the post monsoon water level (**Fig.3**)varies from 0.43 to 4.08 mbgl. The water level fluctuation varies from 0.43 to 7.22 m.(**Fig.4**). The water level trend (for 10 years)for premonsoon period indicates a rising trend in 46% of the stations with significant rise in 2 stations and in the remaining 54% of stations a falling trend is recorded with significant fall in 2 stations. The post -monsoon water level trend indicates a rising trend in 75% of the stations with a significant rise in 4 stations and a falling trend in the remaining 25% of stations with a significant rise in two stations..

The yield in granites varies from 1 to 11 lps. Nearly 23% of the exploratory wells drilled by the department yielded less than 1 lps. About 54 % wells recorded yield in the range of 1 to 5 lps and in the remaining 23% it was more than 5 lps. The Transmissivity value for granites varies from 17 to 219 m²/day.

The oldest basement crystalline rocks and gneisses belonging to the Bengal group cover mostly in the central part of the district. The rock formations are mostly hard and compact Pink and Grey granites,

Table 1 Hydrogeological characteristics of different formations								
S.No	Geological formation	Approximate thickness in mts	No of EW drilled	Drilled depth (mbgl)	Potential zone encountered (mbgl)	Discharge range (lps)	Average discharge of wells (lps)	Transmissivity m ² /day
1.	Jagdapur	180	29	47-251	13-16, 20-26, 28-30, 37-47, 95-99, 120	1-20	< 7.0	36 -395
2.	Kanger	670	4	52-300	17-25, 30-39, 67-70, 80-83, 159-162, 169-172	0.5-14	< 5.00	5 - 331
3.	Cherakur	430	5	50-300	21-37, 64-66	0.1-3	< 1.0	-
4.	Tirathgarh	490	1	54	12-15	1	1	29 - 63
5.	Crystalline s/ Plutonic		11	50-157	25-30, 32-43, 60-62	0.5-18	< 4.0	1 - 44
			50					

intruded by dykes and pegmatite veins. The rocks of Lower Proterozoic Dongargarh Super Group, comprising mainly of fine to medium grained Potash rich Dongargarh Granite and its equivalents are distributed in northern and central parts of the district. The area comes under plateau and hilly region. General elevation of the area is between 550 and 750 m. amsl. Big Granite boulders on hills, formed due to the differential weathering, are a common sight in granitic terrain. Well-developed wide joints can also be seen in various areas. Effect of weathering through joints down to 40 metres can be very well observed during drilling in this formation. Intrusives of pegmatite /quartz vein can be often seen in this granites, So far 11 no of exploratory borewells have been drilled in granites and gneisses down to a maximum depth of 157 meters. Based on the drilling data it can be inferred that the weathered thickness varies from 13 meters to 29 meters. Weathered mantle is the main aquifer which holds considerable potential of ground water. Generally the weathered zone is immediately followed by a fracture.

In granite and gneisses the yield of well depends upon structure, lithology and landform. Of these, structure controlled by lineament plays a major role in controlling the yield. Generally the site located along the lineaments or in close vicinity of lineaments have given high yields whereas sites away from the lineaments have yielded poorly. Felsic rocks (Pink granite) have more fractures compared to mafic and mafelsic rocks. The depth of wells ranges between 60 and 135 m.bgl. Based on the exploration data it can be inferred that the weathered thickness in granites ranges between 16 and 40 mbgl. Weathered granite followed by a fracture at bottom is the only aquifer which possesses good quantity of water. In general the shallow fractured zone lies within 80 m.depth. The yield of this zone varies from 3 to 15 lps and specific capacity varies between 23 and 37 lpm/mdd.

Fig. - 2

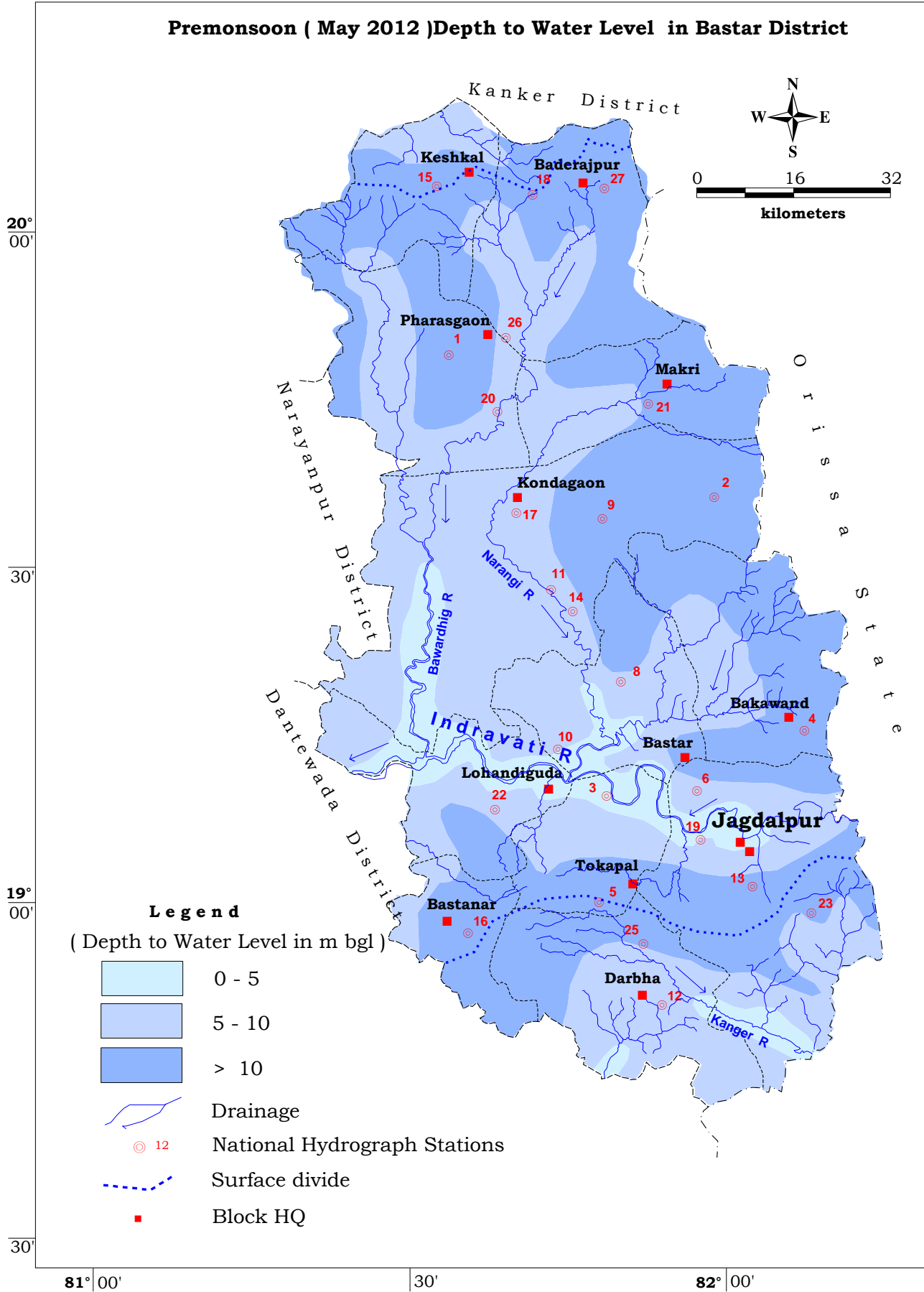
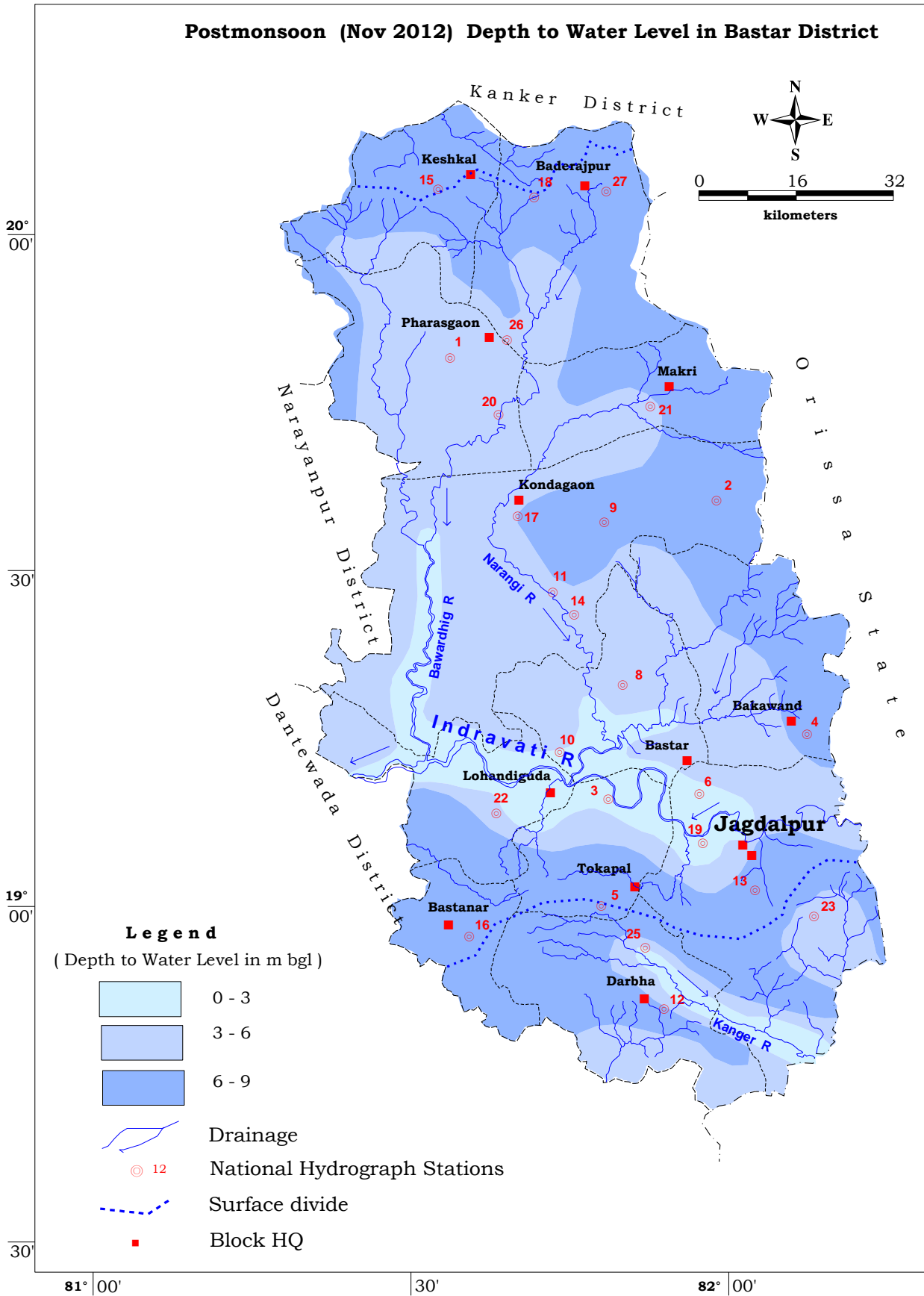


Fig. - 3



Analysis of the data of 11 wells reveal that the average discharge of wells range between 1 and 5 lps.(**Table 1**) The specific capacity of the wells tested is of the order of 1.5lpm/m to 0.61lpm/m. The transmissivity varies from 1-m²/day to 44- m²/day.

3. Ground water resource

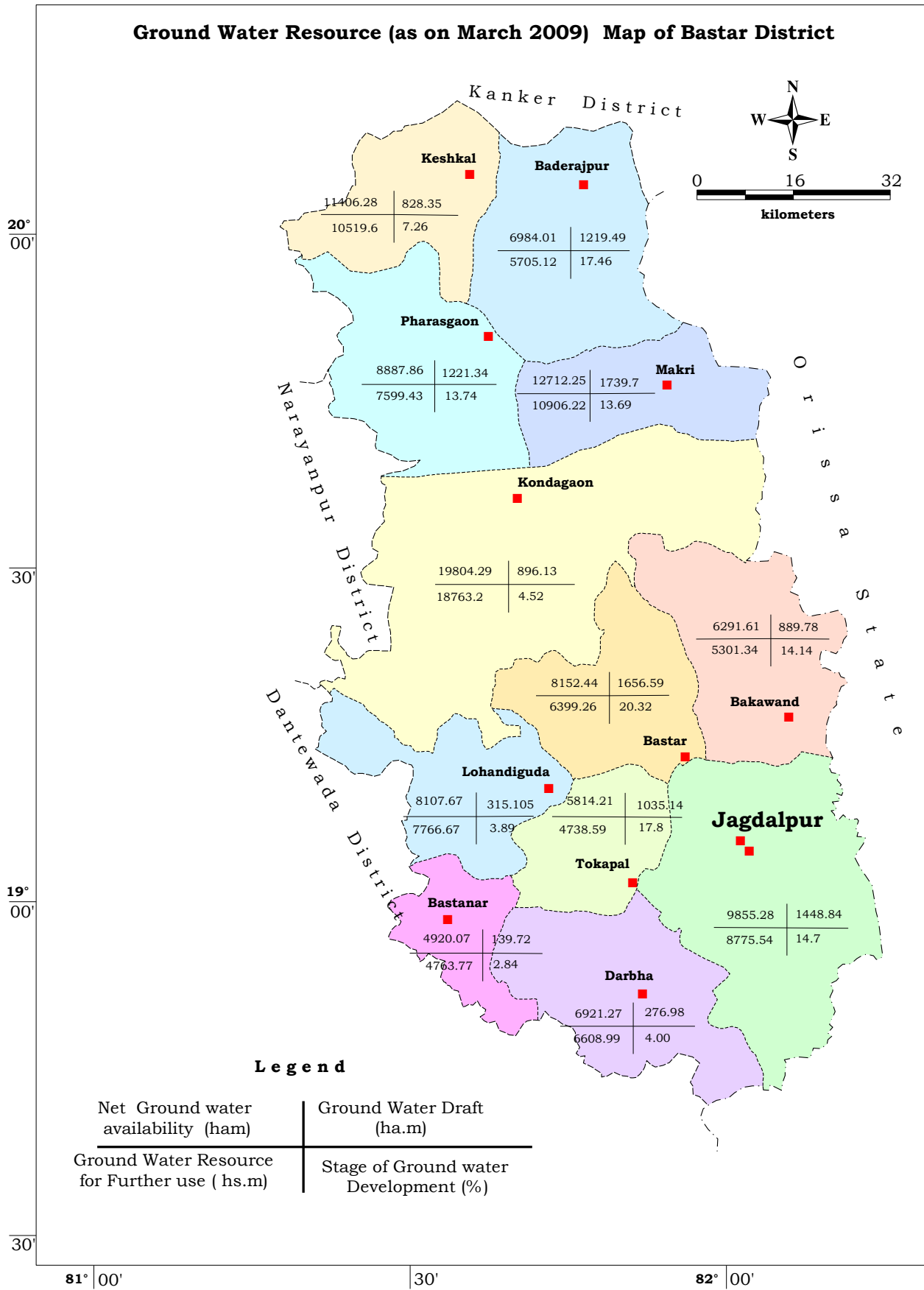
The ground water resources for Bastar district were estimated based on the GEC 1997 methodology and were projected to the year 2009. The estimates indicate that the annual replenishable ground water resource for the district was **1156.39** mcm. The net annual ground water availability was **1098.57** mcm. The gross annual draft was estimated as **116.67** mcm, out of which draft for irrigation was **86.26** mcm and for domestic purpose was **30.40** mcm. The ground water resources for Bastar district is tabulated below table 2 and presented in fig 4

Assessment Unit / Block	Total Annual Recharge in Ham	Net Ground Water Availability in Ham	Existing Gross Ground Water Draft for Irrigation in Ham	Existing Gross Ground Water Draft for Domestic & Industrial Water Supply in Ham	Existing Gross Ground Water Draft for All Uses in Ham	Allocation For Domestic & Industrial Water Supply in Ham	Net Ground Water Availability for Future Irrigation Development in Ham	Stage of Ground Water Development in %
Baderajpur	7351.59	6984.01	1034.06	185.43	1219.49	244.83	5705.12	17.46
Bakawand	6622.75	6291.61	576.04634	313.74	889.78634	414.22	5301.3437	14.14
Bastanar	5179.02	4920.07	36.52	103.2	139.72	119.78	4763.77	2.84
Bastar	8581.52	8152.44	1319.2621	337.33	1656.5921	433.91	6399.2679	20.32
Darbha	7285.55	6921.27	112.83453	164.15	276.98453	199.44	6608.9955	4
Jagdulpur	10373.98	9855.28	779.1	669.74	1448.84	300.64	8775.54	14.7
Keskal	12006.61	11406.28	646.26	182.09	828.35	240.42	10519.6	7.26
Kondagaon	20846.62	19804.29	536.05	360.08	896.13	505.04	18763.2	4.52
Lohangiguda	8534.39	8107.67	166.055	149.05	315.105	174.94	7766.675	3.89
Makdi	13381.32	12712.25	1532.5	207.2	1739.7	273.53	10906.22	13.69
Pharasgaon	9355.64	8887.86	1011.75	209.59	1221.34	276.68	7599.43	13.74
Tokpal	6120.22	5814.21	876	159.14	1035.14	199.62	4738.59	17.8
District	115639.21	109857.24	8626.438	3040.74	11667.178	3383.05	97847.752	10.62

4. Ground water development

The stage of ground water development estimated for Baderajpur block is 17.46 %, for Bakawand block is 14.14 %, for Bastanar block is 2.84%, for Bastar block is 20.32 %, for Darbha block is 4.00%, for Jagdulpur blocks is 14.7 %, for Keskal block is 7.26 %, for Kondagaon block is 4.52 %, for Lohandiguda block is 3.89 %, for Makri

Fig. - 4



block is 13.69%, for Pharasgaon block is 13.74% and for Tokapal block is 17.8 %. The over all stage of ground water development for the district is 10.62 %.The block wise stage of ground water development in the district is depicted in **Fig .4**. The yield potential and the recommended suitable abstraction structures for the area are shown in **Fig.6** .

The dug well depth varies from 6 to 15 m and the dia varies form 2.4 to 3.1 m. The bore wells drilled in the area are 60 to 90 m deep with dia varying from 0.10 to 0.15 mm. Diesel or electric operated pumps of 0.50 to 1HP or traditional teda is used to lift the water from dug wells for the irrigation purposes. The electrical pump or rope and bucket are used to lift the water for domestic purpose. Submersible electrical pumps of 3 to 5 HP are used for irrigation purpose in case of bore wells in the area. The bore wells in granitic terrain can irrigate an area of 0.5 to1.5 ha for paddy crops.

Ground water is the main sources of drinking water in the district covering 1087 no of villages.

In all 1923 no of bore wells and 2460 no of dug wells exist in the district. Together they irrigate around 2942 ha. The contribution of ground water for irrigation comes to nearly 30.67% in the district. The use of ground water in non-command area is maximum.

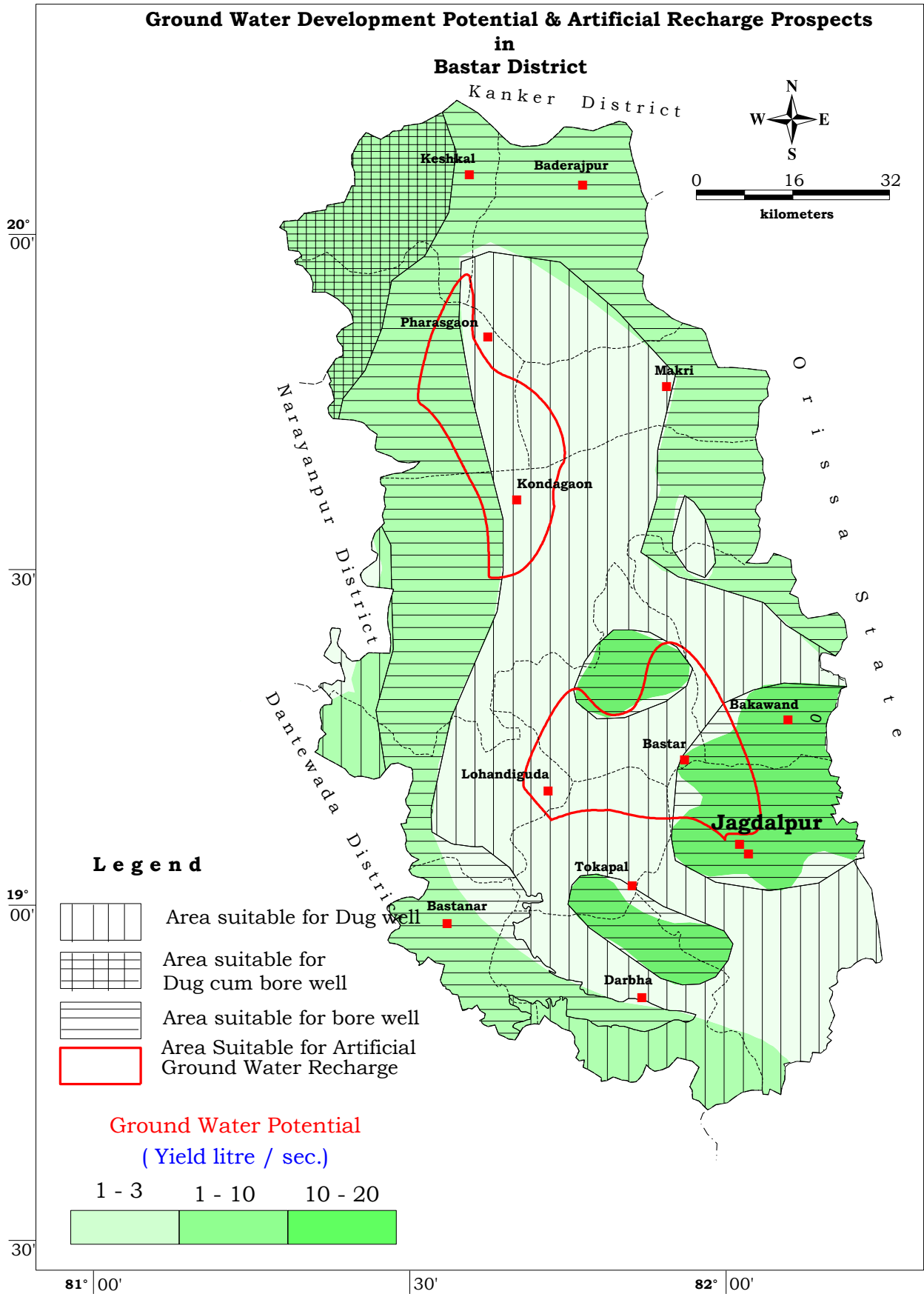
5. Ground water quality

The water samples collected from NHS stations during the month of May 2006 (premonsoon) were analysed to determine the quality of ground water in the district. The analysis shows that the major ions are as per BIS standard and the ground water in the district is suitable for all purposes.

The plot of Piper tri linear diagram and US salinity diagram indicates that the ground water in the district is suitable for drinking, irrigation and all other purposes. The EC values are comparatively high(>750) in the central part of the district . The EC values particularly in granitic terrain range between 255 to 1060 micro siemens/cm at 25°C and the pH values range between 7.8 and 8.2. In sedimentary rocks the EC values ranges between 80 and 685 micro siemens /cm at 25°C and the pH values ranges between 7.7 and 8.1. The over all composition of ground water indicates that it is moderately alkaline and predominantly CaHCO₃ type (Calcium bicarbonate type).

6. Ground water management strategy

Fig. - 6



There exists a wide scope for ground water development in the district. The available ground water resources for the district are of the order of **1098.57** mcm and the ground water draft is **116.67** mcm. The stage of ground water development is only 10.62 %.

It is estimated that with the available ground water resources, a total of 42,204 no. of dug wells and 45,018 no. of bore wells can be constructed in the district. By adopting suitable developmental strategies, the less developed blocks of Bastanar, Darbha and Lohandiguda can be further developed by way of increased irrigation.

7. Water Conservation and Artificial Recharge

The normal annual rainfall for the district is 1386.77 mm. There exist a huge surplus non-committed run off in the district. Rain water harvesting and artificial recharge structures at suitable locations can be constructed to improve the storage capacity of the surface and subsurface reservoirs.

8. Awareness and Training activity:

So far two training programs on ground water conservation, and artificial recharge. in 2004-05 and 2005-06 and one mass awareness program in 2004-05, were conducted by the department at Jagdalpur. Representatives from PHED, State Ground Water Survey dept. and Forest department, NGO's and ground water professionals were trained during these programs.

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Figure - 5

