

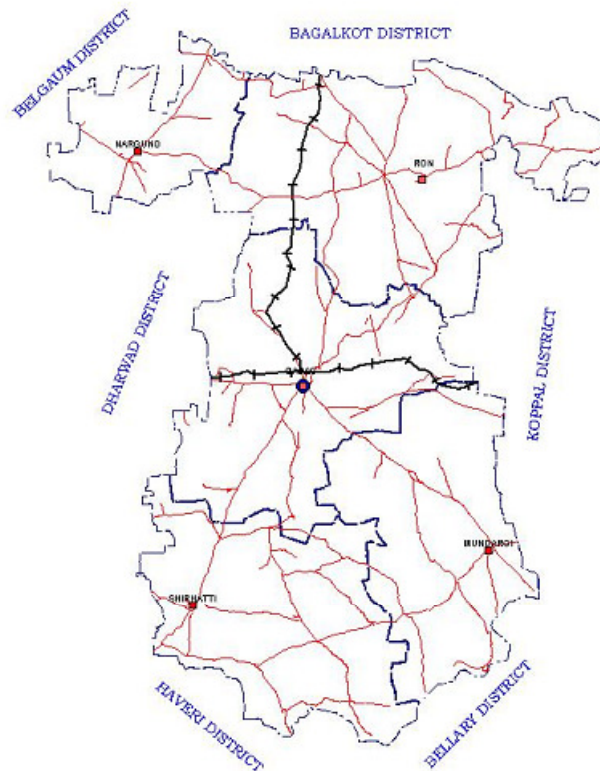


स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल
CONSERVE WATER - SAVE LIFE



**GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD**

**GROUND WATER INFORMATION BOOKLET
GADAG DISTRICT, KARNATAKA**



**SOUTH WESTERN REGION
BANGALORE
JANUARY 2009**

FOREWORD

Ground water contributes to about eighty percent of the drinking water requirements in the rural areas, fifty percent of the urban water requirements and more than fifty percent of the irrigation requirements of the nation. Central Ground Water Board has decided to bring out district level ground water information booklets highlighting the ground water scenario, its resource potential, quality aspects, recharge – discharge relationship, etc., for all the districts of the country. As part of this, Central Ground Water Board, South Western Region, Bangalore, is preparing such booklets for all the 27 districts of Karnataka state, of which six of the districts fall under farmers' distress category.

The **Gadag** district Ground Water Information Booklet has been prepared based on the information available and data collected from various state and central government organisations by several hydro-scientists of Central Ground Water Board with utmost care and dedication. This booklet has been prepared by **Shri K.N.Nagaraja, Scientist-D**, under the guidance of Dr. K. Md. Najeeb, Superintending Hydrogeologist, Central Ground Water Board, South Western Region, Bangalore. The figures were prepared by S/Sri. H.P.Jayaprakash, Scientist-C and K.Rajarajan, Assistant Hydrogeologist. The efforts of Report processing section in finalising and bringing out the report in this format are commendable.

I take this opportunity to congratulate them for the diligent and careful compilation and observation in the form of this booklet, which will certainly serve as a guiding document for further work and help the planners, administrators, hydrogeologists and engineers to plan the water resources management in a better way in the district.

(T.M.HUNSE)
Regional Director

GADAG DISTRICT AT A GALANCE

SI No	ITEMS	Statistics
1.	GENERAL INFORMATION	
	i) Geographical area (Sq.km)	4656
	ii) Administrative Divisions	
	a) Number of Taluk	5
	b) Number of panchayat/S	106
	iii) Population (As on 2001 Census)	971835
	iv) Average Annual Rainfall (mm)	612.3
2.	GEOMORPHOLOGY	
	Major physiographic units	02
	Major Drainages	02
3.	LAND USE (Ha)	
	a) Forest area	32614
	b) Net area sown hect	3866
	c) Cultivable area	
4.	MAJOR SOIL TYPES	2, (a)granitic soils and (b)sandy to clayey soils
5	AREA UNDER PRINCIPAL CROPS (Ha)	
	Jowar	93659
	Turdal & other pulses	2784
	Groundnut	57846
	Cotton	59813
	Paday	1543
	Wheat	36348
	Maize	22621
6.	IRRIGATION BY DIFFERENT SOURCES (Ha)	
	Dug wells	2008
	Bore wells	26856
	Tanks	1246-
	Canals	20016
	Other sources	5246
	Lifts	1309
	Gross irrigation area	62766
7.	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB	
	No of Dug wells	19
	No of Piezometers	8
8.	PREDOMINANT GEOLOGICAL FORMATIONS	, Granites & Gneisses Dharwar super group of schists, metagrey wacks, ferruginous cherts
9.	HYDROGEOLOGY	
	Major water bearing formation	Granites , Gneisses& Dharwar schist
	Pre-monsoon Depth to water level range during-2006	4.22-23.67 mbgl.

	Post-monsoon Depth to water level range during-2006	5.30 – 24.70 mbgl.	
	Long term water level trends for the period 1998 - 2007	Premonsoon trends available for 13 stations	3 Rising trends range between 0.10 and 2.36 m/year. 10 falling trends range between 0.059 and 0.58 m/year.
		Postmonsoon trends available for 16 stations	3 Rising trends range between 0.22 and 1.74 m/year. 13 falling trends range between 0.05 and 0.704 m/year.
10.	GROUND WATER EXPLORATION BY CGWB (As on 31.3.2007)		
	No of wells drilled (EW, OW, PZ, SH, Total Depth range (m)	15- EW 17-OW	19.55 - 196.95 m 60.0 –105.85 m
	Discharge (litres per second)	nil – 6.60 lps	
	Specific capacity lmin/m	3.12-68.99	
	Transmissivity (m ² /day)	1.07-94.93	
11.	GROUND WATER QUALITY		
	Presence of chemical constituents more than the permissible limit (e.g. EC, F, As, Fe)	Electrical Conductivity, Nitrates and Fluoride.	
	Type of water	Potable to Brackish	
12.	DYNAMIC GROUND WATER RESOURCES (2004) IN MCM		
	Annual Replenishable GW resources	24605	
	Net Annual Ground Water Draft	22102	
	Projected Demand for Domestic and industrial uses up to 2025	3033	
	Stage of G W Development	94%	
13.	AWARENESS AND TRAINING ACTIVITY	nil	
	Mass Awareness Programme organised and No. of participants	nil	
14	EFFORTS OF ARTIFICIAL RECHARGE & RAINWATER HARVESTING	Display of posters, Distribution of pamphlets, brochures & stickers, Organising drawing competitions in schools, conducting awareness and training programmes, Delivering lectures, and presenting through power points and showing documentaries	

	Projects completed by CGWB (No & amount spent)	nil
	Projects under technical guidance of CGWB (Numbers)	nil
15.	GROUND WATER CONTROL AND REGULATION	nil
	OE Area in %	71% in Gadag85% in Naragund & Ron taluks
	Critical area in %	-
	No of Blocks notified	Nil
16.	MAJOR GROUND WATER PROBLEMS AND ISSUES	Rainfall is erratic, drought prone district Application of traditional farming and irrigation methods, unscientific development of groundwater, Brackishness and salinity of groundwater, fluoride problem

1.0 INTRODUCTION

Gadag district is newly created on 1-11-1997, bifurcating Gadag, Mundargi, Nargund, Ron, Shirhatti taluks from the old Dharwad district. Gadag district is located in northern parts of Karnataka and situated in between north latitudes of 15° 15' and 15°45' and east longitudes of 75°20' and 75°47'. It is bounded by Koppal district on east, by Bagalkote district on north, by Haveri district on south and by Dharwad district on west.

1.1 Administrative division

For administrative convenience, the district is divided into 5 taluks with total of 337 villages. It contains 3 town municipalities, 5 town panchayaths and 11 hoblies. A map showing administrative details of the district is presented as **Fig-1**. The details are given in table -1

Table - 1 showing administrative details of Gadag district (as per 2001 census).

Sl No	Taluk	No. hoblis	Gram panchayats	No of un-inhabited villages	No in-habited villages	towns	municipalities	Town Panchayat
1	Gadag	2	25	61	3	1	-	1
2	Mundargi	2	15	57	1	-	-	1
3	Nargund	2	12	34	1	-	1	-
4	,Ron	3	30	93	-	-	1	2
5	Shirhatti	2	24	80	7	-	1	1
	TOTAL	11	106	325	12	1	3	5

1.2 Basin and drainage

The district is a part of Krishna basin, divided into two sub basins namely Malaprabha, and Tungabhadra. These have an area of 2768 km² and 1889.2 km² respectively. A tributary of Malaprabha river, Bennehalla flowing parallel to the main river joins Malaprabha river in Ron taluk which is located north eastern part of the district. Overall drainage network is exhibiting dendritic pattern. A drainage map of the district is given as **Fig-2**.

1.3 Irrigation

Details of the area irrigated by different sources, net area irrigated is given in table-2

Table - 2 Details of the area irrigated by different source in gadag district 2004-05 (in ha)

Taluks	Canals	Tanks	Wells	Bore wells,	Lift irrigation	Others sources
Gadag	-	70	219	4520	-	10
Mundargi	-	1072	-	5444	6868	-
Naragunda	33708	-	1220	1555	-	3199
Ron	861	30	-	13455	-	1871
Shirhatti	-	344	788	6054	41	1282
Total	34569	1516	2008	31028	6909	6362

The table- 3 reveals that about 60% of the area was irrigated by surface water sources ie- through canals, tanks, lift irrigation, and other sources. Remaining 40% area was irrigated through ground water source like dug wells and bore wells during 2004- 05

1.4 Landuse

In the district during 2003-04 about 80% area is net irrigated, about 7% of the area is covered by forest and net sown area is about 83% of geographical area. the details of land utilization given in table –3.

Table no-3 showing land utilization in Gadag district during 2003-04 in hectares

Taluk	Geo-graphical area	Forest	Cultivable Waste	Barren Current	Permanent Pasture	Net area sown	Area sown more than once
Gadag	109751	1749	291	18302	1054	85004	15366
Mundargi	88398	17646	163	8126	280	57031	-
Naragund	43562	-	-	2996	52	36205	1003
Ron	129091	276	370	-	428	120588	3701
Shirhatti	94913	12943	186	388	778	74368	15984
Total	465715	32614	1010	29812	2592	373196	36054

1.5 Main crops

In the district as per district at a glance of 2004-05 total net area sown is 386666 ha. It is 84% of total geographical area. Principal crops in the district are Jawar occupying 24%, groundnut 14%, sunflower 22%, cotton 15% and wheat 9% of the net sown area and other crops like paddy, ragi, turgram, vegetables are also grown. Normally in command areas of the district crops like sugarcane, maize and jawar, wheat, gram, paddy and pulses are grown while in non-command areas sunflower, groundnut, chillies, millet and pulses are grown. And normally in command areas of the district crops are grown like sugarcane maize, jawar, wheat, gram, paddy and pulses while in non command areas sun flower, groundnut, chillies, millet and pulses are grown.

Table -4 Taluk wise area under different principal crops in Gadag district

Taluks	Jowar	Maize	Wheat	Ground nut	Sun flower	Safflower	Tur	Cotton
Gadag	21067	921	8427	14490	13906	1471	464	19763
Mundargi	15011	11202	4225	9524	20048	707	893	9024
Naragund	11187	11202	8066	247	8660	258	91	633
Ron	27357	4802	13064	12486	29475	1873	798	17626
Shirhatti	19037	2297	2566	21099	12017	833	538	12817
Total	93659	22621	36348	57846	84106	5142	2784	59813

1.6 Work carried out by CGWB

The central ground water board has carried out systematic Hydrogeological surveys Reappraisal Hydro geological surveys and Malaprabha

and Tungabhadra canal command area surveys, ground water exploration and ground water regime monitoring etc.

2.0 GEOMORPHOLOGY&SOIL TYPES

The district falls in the semi arid tracts of Karnataka. The annual rainfall is generally less than 750mm. It lies to the east of the western ghats in the rain – shadow region. Hence receives low rainfall and generally drought prone and it is a part of Krishna major basin the district drained by two main rivers namely Malaprabha and Tungabhadra. Malaprabha along with its tributary Bennihalla drains northern parts and two rivers join at Ron taluk. The Malaprabha and Tungabhadra sub basins have the area of 2768 sq km and 1889.2 sq km respectively. The area of the district is plain to gently undulating terrain varies in altitude from 508m-740m amsl. Malaprabha river sub basin is sloping towards north- east direction. And Tungabhadra river sub basin slopes towards south-east to east –north-east direction. Master slope is 1.25m/km where as Malaprabha river has 0.5m/km slope. Both rivers show a seasonal regime varying from lean sluggish flow during summer to torrential muddy flow during the monsoon. The area of the district is generally covered by medium to deep black soils and extends up To 1.80 m b.g.l. Average being 1.10 mbgl. The constant rate of infiltration in sandy to clayey residuum ranges between 0.5 to 4.5cm/hr. Phyllitic soils are confined To hilly region.

3.0 RAINFALL AND CLIMATE

The district falls under semi arid tract of the state and it is categorized as draught prone. And normal rainfall is 613 mm. The north-east monsoon contributes nearly 24.8% and prevails from October to early December. And about 54.7% precipitation takes place during south –west monsoon period from June to September. And remaining 20.5% takes place during rest of the year. In the district from December to February month is winter season, During April to May temperature reaches up to 42°C and December and January temperature will go down up to 16°C. The standard deviation of rainfall in the district varies from 1.3 to 263.5mm from west to east. The average standard deviation for the district is about 146 mm. South West monsoon is dominant followed by north-east monsoon. Taluk wise rainfall details are shown in table –5.

Table – 5 Taluk wise rainfall details in gadag district, Karnataka

.Taluks	Working Rain gauges	Actual rainy days(05)	Normal rain fall in mm	Actual rain fall in mm	Normal rainy days1901 -1970
Gadag	3	55	665.7	773,7	46
Mundargi	4	38	489.0	482.4	34
Naragund	2	44	545,0	435.3	39
Ron	3	43	613.1	680,8	42
Shirhatti	4	48	748.9	673.5	55
Total	16	46	612.3	609.1	43

4.0 GROUND WATER SCEINARIO

4.1 Hydrogeology

The district is underlain by hard rock formations like granites, gneisses, and schists. These rocks have no primary porosity or permeability. Ground water occurs under phreatic conditions in weathered zone of these formations. At higher depths ground water occurs under confined to semi-confined conditions in fractures and joints as well as formation contacts, its movement is controlled by the interconnectivity and geometry of the structurally weak zones called lineaments. In the district the ground water is developed through dugwells and dug cum- bore wells up to 20 m depth. a hydrogeological map of the area is given as **Fig-3**.

4.1.1 Depth to water levels

Pre-monsoon (May-2006) depth to water level of 4.22mbgl minimum and 23.67mbgl is maximum, patches of 2-5 mbgl water level category is noticed in Mundargi taluk and a small patch in Shirhatti taluk has recorded more than 20mbgl depth to water level. Parts of Gadag, Mundargi and Shirhatti taluks are showing 5-10m range. A patch of Nargund taluk showing 5-10mbgl range. Major parts of the district occupied by 10-20mbgl range. A premonsoon depth to water level map is presented as **Fig-4**. During post monsoon (Nov 2006) ground water levels ranges from minimum of 5.30mbgl at Chabbi station to maximum of 24.70m at Kotbal station, 2-5mbgl depth to water level category is observed in parts of Mundargi and Shirhatti taluks. 5-10mbgl water level category is observed in major parts in Shirhatti, Gadag, Mundargi and Nargund taluks. 10-20mbgl depth water level category is observed in major part in Ron taluk and parts of Gadag, Mundargi, Shirhatti, Nargund taluks. . A postmonsoon depth to water level map is presented as **Fig-5**.

4.1.2 Long term trends of water levels

Long term water level trends for the period 1998 – 2007 were studied to know the changes in water levels in last ten years period. Premonsoon trends were available for 13 stations out of which at 3 network stations have rising trends ranging between 0.10 and 2.36 m/year and water levels at 10 network stations have falling trends in the range of 0.059 and 0.58 m/year. Postmonsoon trends available for 16 stations of which 3 have rising trends in the range between 0.22 and 1.74 m/year and 13 have falling trends in the range of 0.05 and 0.704 m/year.

4.1.3 Ground water exploration

In the district central ground water board drilled 15 exploration wells with depth range of 19.55m to 196.95 mbgl and 9 Observation wells with depth range of 60.0 to 105.85mbgl. It reveals that these wells recorded specific capacity in the range of 3.12 to 68.99 l/min/m drawdown and transmissivity range between 1.07

to 94.93 m²/day. The discharge of these wells were recorded almost nil to 6.60lps.

4.2 Ground Water Resources

Ground water is a important source to meet the water requirement of like domestic and minor irrigation, industries. The development of ground water requires precise of quantitative assessment based on scientific principles. By application of ground water estimation methodology-1997 (GEMS-97) is shown in following table.

Table-6A

Taluk	Recharge from rainfall during monsoon (ham)	Recharge from rainfall during nonmonsoon (ham)	Recharge from other source during monsoon season	Recharge from other source during non monsoon season	Annual replinable G.W .resource	Net G.W. availability
Gadag	2971	724	858	911	5463	5710
Mundargi	3160	700	396	514	4697	4848
Nargund	743	153	287	226	1412	1474
Nargund (poor)	670	600	590	592	2531	619
Ron	3031	985	765	1099	5896	6128
Shirhatti	2690	911	618	413	4606	4754
Toatal	13265	4073	3514	3755	24605	23533

Table-6B

Taluk	Irrigation draft in ham	Domestic & Industrial draft in ham	Total G.W.draft in ham	Projected draft for domestic & industrial draft for year 2025 in ham	G.W. availability for irrigation in ham	Stage of development.in %	Categorisation of area in % based on stage of development			
							Safe	semicritical	Critical	Over exploited
Gadag	4615	499	5114	708	1726	90	18	11	-	71
Mundargi	3936	291	4228	443	582	87	27	73	-	-
Nargund	1524	169	1693	237	459	115	15			85
Nargund (poor)	0	0	0	0	0	0	-	-	-	-
Ron	7203	765	7968	1062	642	130	-	-	-	100
Shirhatti	2688	411	3099	584	1603	65	100			
Total	19966	2135	22102	3034	5012	93.92				

4.3 Ground Water Quality

To assess the ground water quality of shallow aquifers of the district the chemical analysis data of water samples from national hydrograph network stations of May 2004 were used. As per this ground water is mild alkaline, E.C. ranges from 650 to 8010 in micro mhos /cm at 25°C. The Nitrate pollution is also noticed in the district up to 450ppm at ramgiri Station, fluoride content in the ground water in the district varies from 0.2 to 2.55 ppm minimum is recorded at Mallapur and maximum at Shirhatti Station.

A ground water quality map prepared and presented as **Fig- 7**. As per the Fig, the ground water in the areas located in the western parts of Ron taluk, north eastern parts of Ron taluk, western parts of Gadag taluk, western and southern parts of Shirhatti taluk have high nitrate content. The ground water in major parts of both Gadag and Ron taluks and south central parts of Mundargi taluk have analysed high Fluoride content.

4.4 Status Of Ground Water Development

Based on GEMS 1997 methodology the dynamic ground water resources as on march 2004 is computed and same is presented in the table as per this total annual replenishable ground water resource is estimated as 24605 ham, and draft for irrigation during the period is estimated as 19966 ham. The stage of development O.E Ron taluk and Gadag is 71%, Nargund taluk %85, Shirhatti taluk is safe. According to minor irrigation census 2000-01, it is recorded 2201 dug wells, 6772 shallow bore wells, 57 dug cum bore wells are present. A map showing ground water utilisation in the district as **Fig-6**.

5.0 GROUND WATER MANAGEMENT STRATEGY

Since, the district with the major part of the domestic water and agriculture demand met from groundwater the water management aspect become an integral part for all round socio economical development of the region, in addition to that the environmental management and ecological stability. Hence, a proper groundwater management strategy is essential to make most economical, efficient and judicious use of water to achieve sustainable development of the resource.

The development of water supply model should be resource based and should be from the point of view of total supply and demand.

Keeping in view, with the statistical data of water resources, population growth and its utilization pattern, additional demand within the priority areas of Drinking, Irrigation and Industrial sector can be identified. And, hence the resource allocation becomes handy to ensure the optimum distribution of resources in the needy areas.

6.0 GROUND WATER RELATED ISSUES AND PROBLEMS.

Though the study area enjoys a low to moderate annual rainfall resulted in drought (R.F.deficiency) condition and saline nature of ground water especially in parts of Nargund taluk experiencing shortage of safe water for domestic use. As

per the ground water estimation studies the whole of Ron taluk, 85% of Nargund taluk and 71 % of area of Gadag taluk are overexploited, as indicated in Fig.-6. The quality deterioration in many parts of the district can be attributed partly to the natural means of decomposing of host rock/aquifer by prevailing weather condition over the year or indiscriminate dumping of wastes on the land and usage of chemical fertilizers in the agricultural land by human activities also leads to groundwater deterioration.

The wells sunk in schistose rock aquifers and highly weathered granitic as well as gneissic rock aquifers in the eastern parts the wells go dry for several months during summer periods. The present water supply to Gadag and other semi-urban areas in the district are reported to be inadequate especially during summer months. This scarcity is not only because of limited source but also because of leakage and other losses through pipeline network.

7.0 RECOMMENDATIONS

1. Dimensions of recommended Wells may be as per topographical conditions. In general, the diameter of the dug wells may be 3-4m with a depth of 10-12m in granites gneisses
2. Where as in schistose formation diameter may extended up to 5m, depth may be kept up to 12-15m and to increase the yield in shallow wells bore wells may be constructed with a diameter of 100mm below the dug well part up to a depth of about 15-20m.
3. In phyllite formation as far as possible, dug wells may be avoided and the ground water may be developed through shallow borewells.
4. In the fractured granites, gneisses, schists and metagreywacks the borewells are recommended to a depth range of 65-120m depending upon intersecting fracture, sheers and joints etc.
5. The average spacing between two structures to avoid interference of the wells may be kept 200 m.
6. The ground water with High salinity (TDS) may be used to grow salt tolerant crops.
7. In areas with high nitrate content in ground water, the farmers may be advised to stop the indiscriminate usage of nitrate fertilizers.
8. In areas with High Fluoride content in ground water, use of ground water for human consumption may be avoided with out defluoridation or without blending with surface water in proper proportion.
9. In the ground water over exploited areas, artificial recharge may be taken up by desilting surface water bodies, by recharge through dug wells and by constructing other suitable artificial recharge structures.
10. Reassessment of ground water resources may be carried out with more refined norms.

11. In the district flood irrigation may be avoided by using ground water and micro-irrigation systems are recommended.
12. In the areas categorised as safe from stage of ground water development point (see Fig-6) ie -27% in Mundargi taluk, 18%,in Gadag taluk. 15% in Nargund taluk and 100% in Shirhatti taluk ground water may be used for irrigation by constructing suitable ground water abstraction structures with annual unit draft of 0.8ham.
13. For pin pointing dugwell/ borewell sites remote sensing data, hydrogeological survey data and geophysical survey data may be used.

Fig- 1

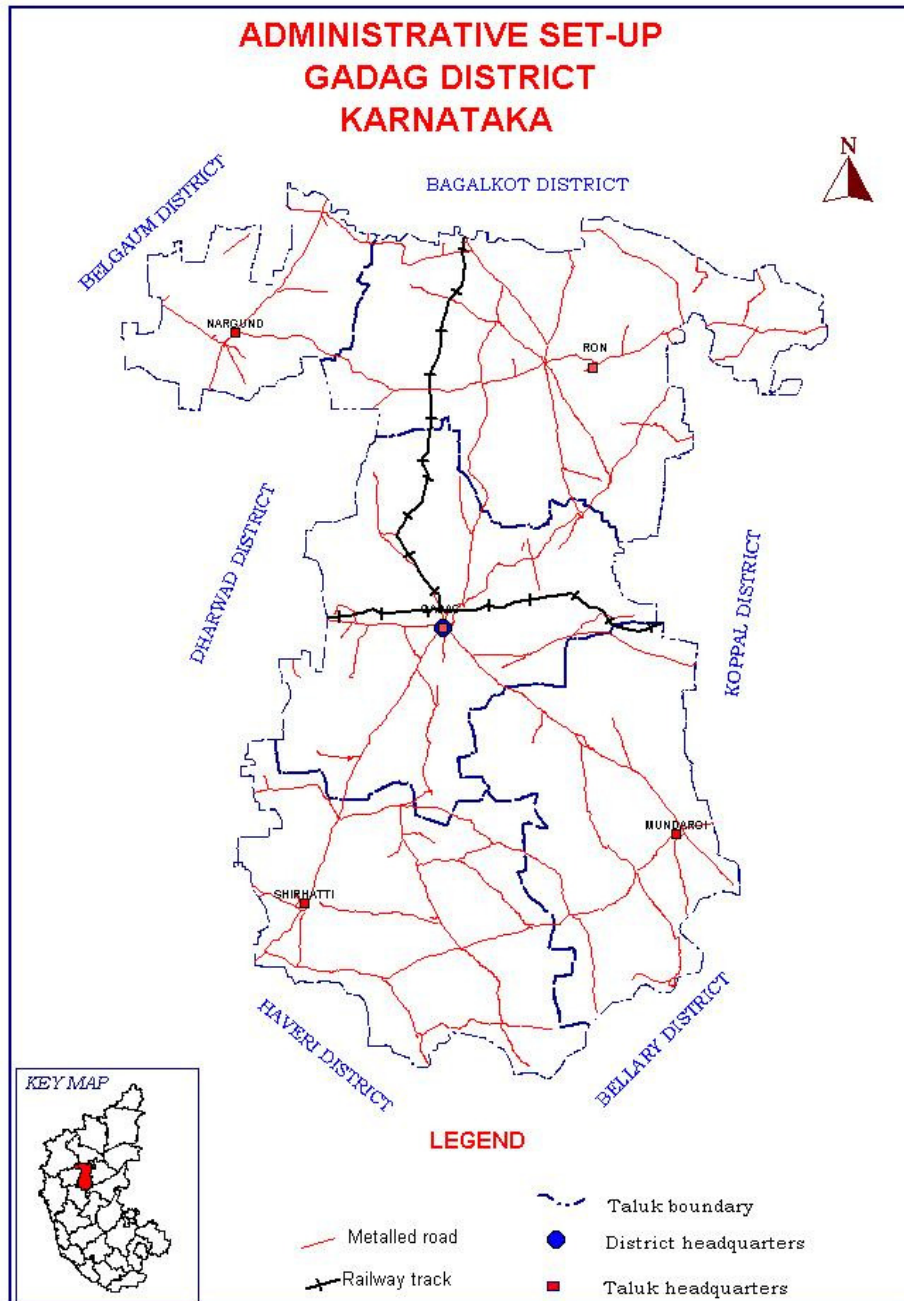


Fig-2

DRAINAGE & HYDROGRAPH MONITORING STATIONS GADAG DISTRICT, KARNATAKA

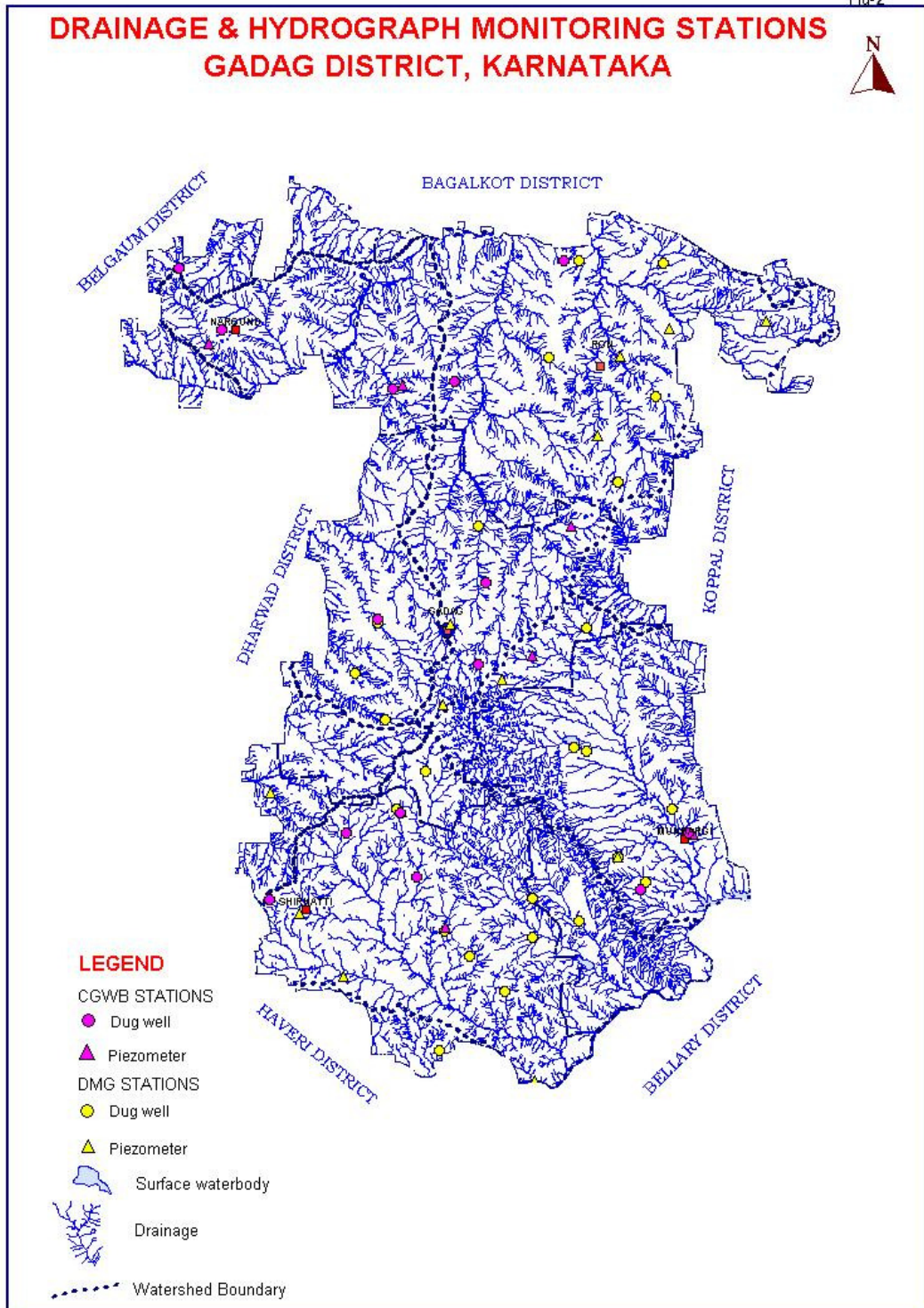


Fig-3

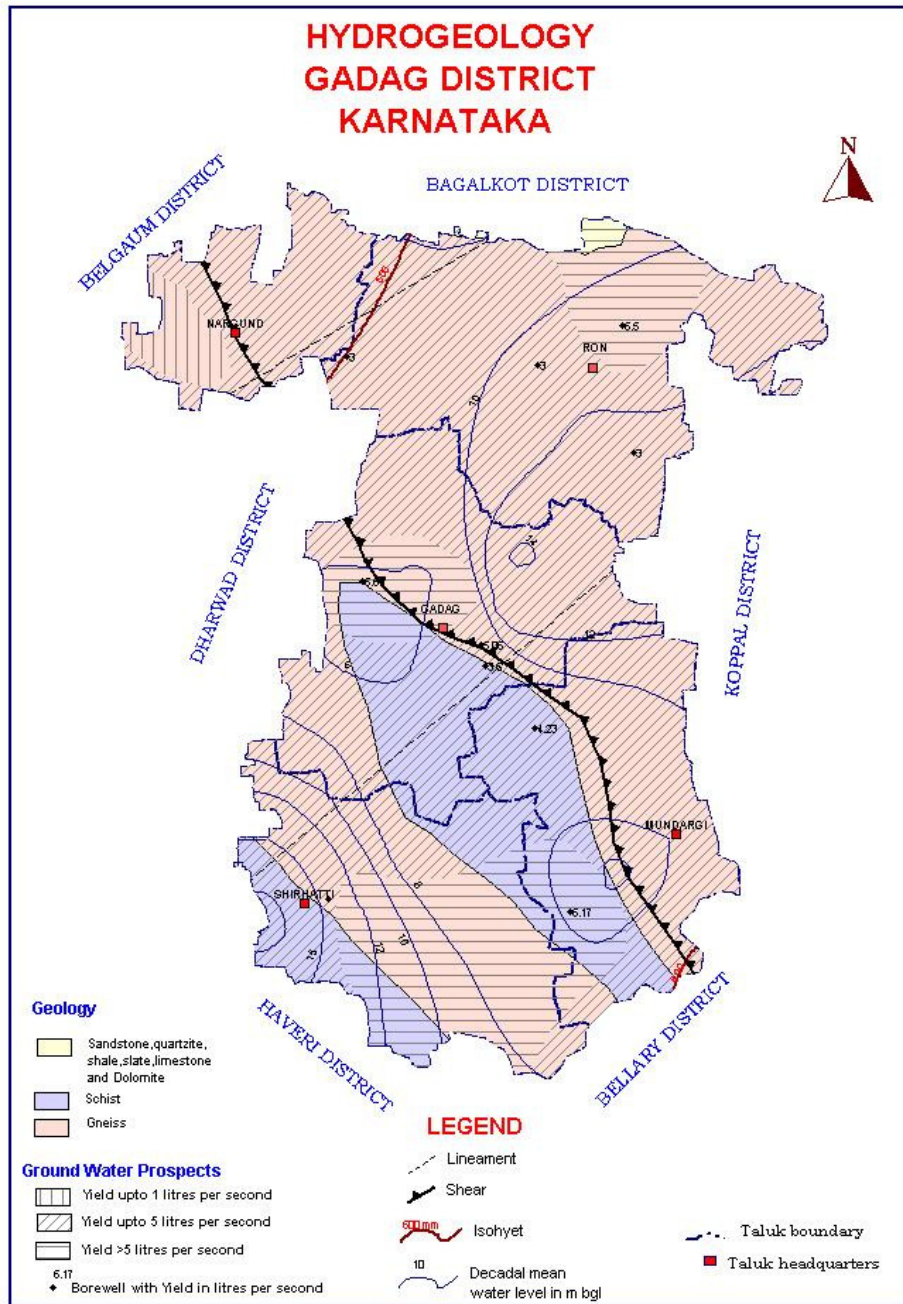


Fig-4

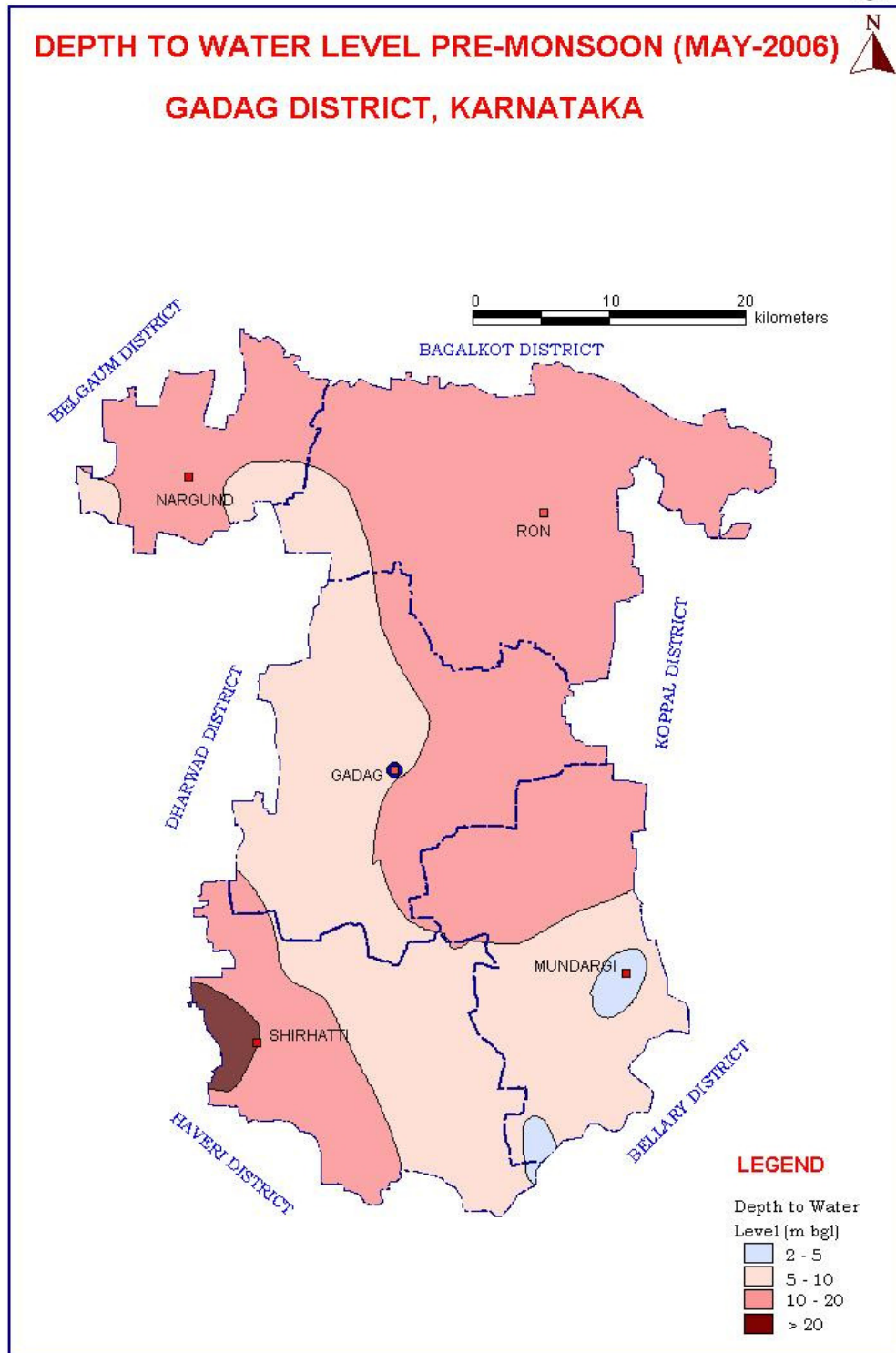


Fig-5

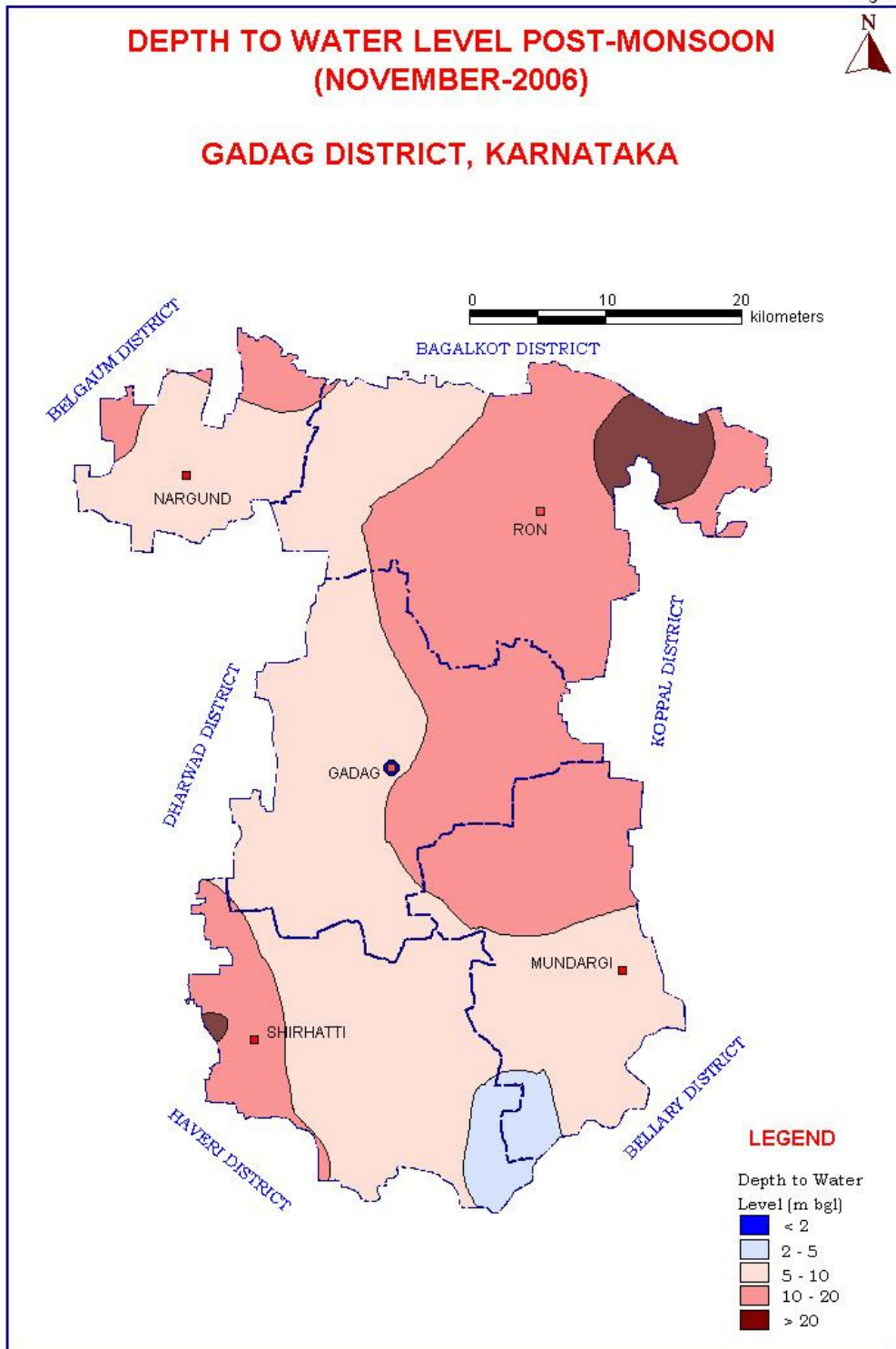


Fig-6

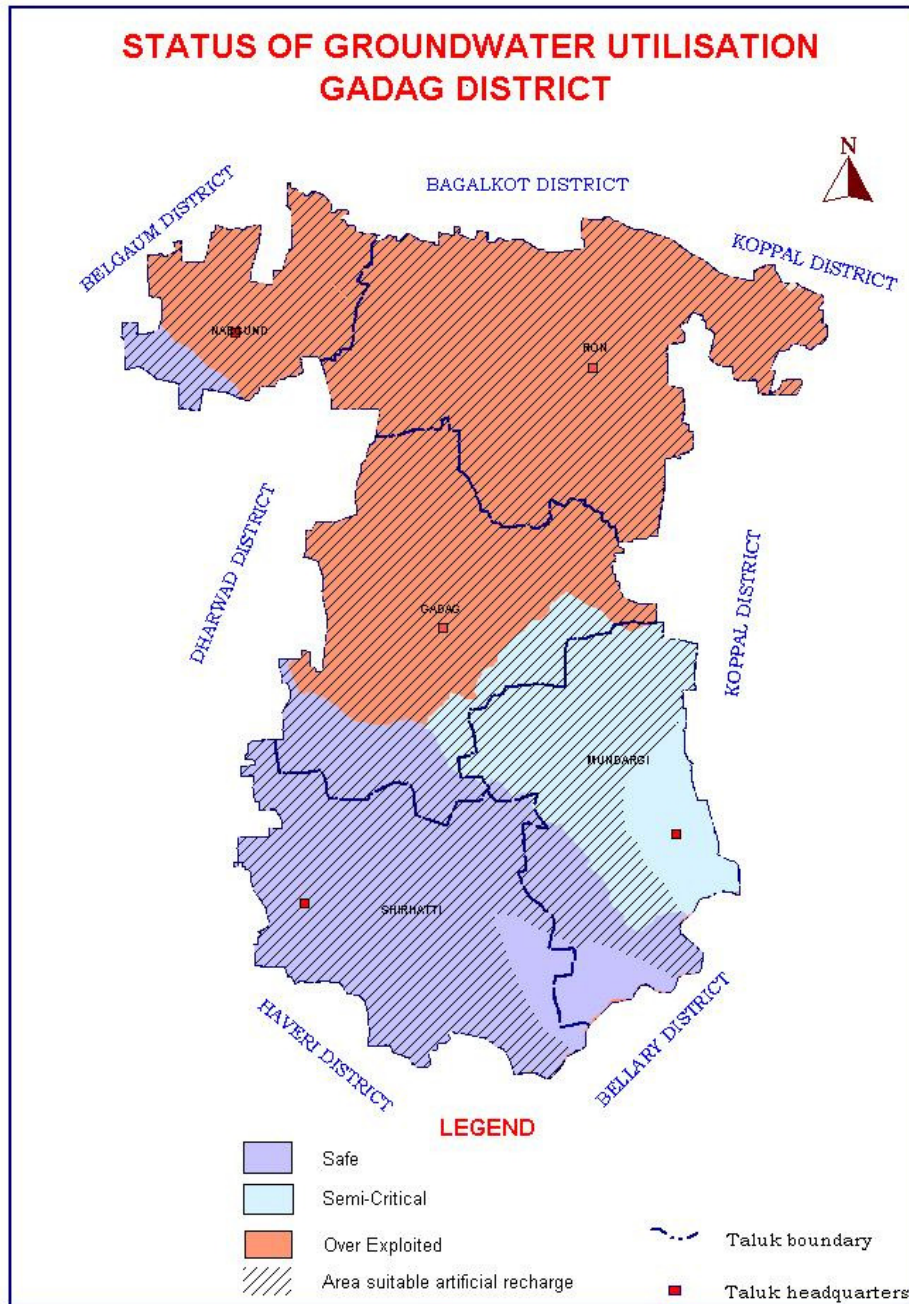


Fig-7

