जल वर्ष 2007 Water Year 2007

स्वच्छ सुरक्षित जल – सुन्दर खुशहाल कल

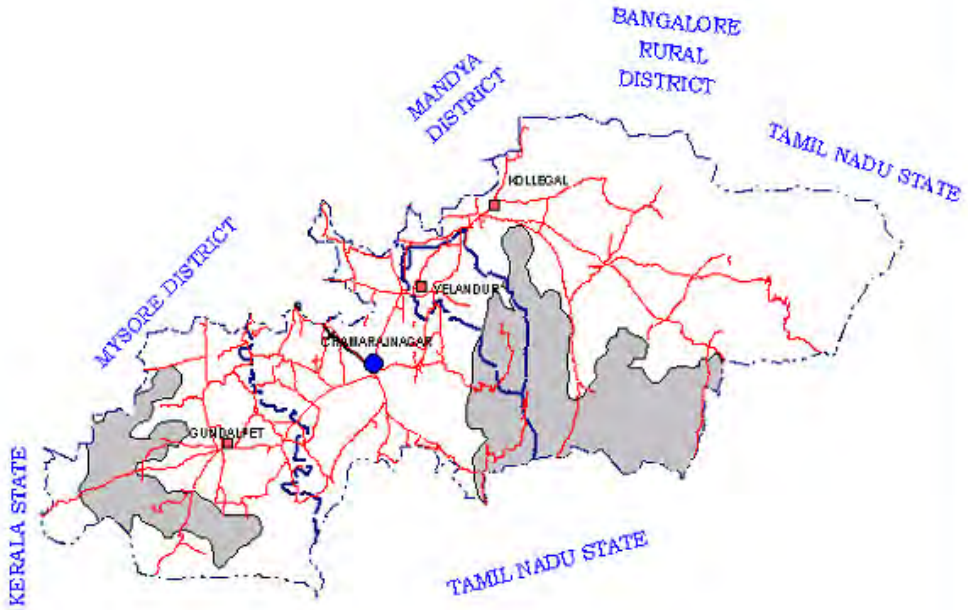
CONSERVE WATER - SAVE LIFE

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES

CENTRAL GROUND WATER BOARD

GROUND WATER INFORMATION BOOKLET

CHAMARAJNAGAR DISTRICT, KARNATAKA



SOUTH WESTERN REGION
BANGALORE
AUGUST 2012

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भारत सरकार
केन्द्रीय भूमि जल बोर्ड
जल संसाधन मंत्रालय
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Foreword

Groundwater is an essential component of the environment and economy. It sustains the flow in our rivers and plays an important role in maintaining the fragile ecosystems. The groundwater dependence of agrarian states like Karnataka is high. Recent studies indicate that 26 percent of the area of Karnataka State is under over exploited category and number of blocks is under critical category. In view of the growing concerns of sustainability of ground water sources, immediate attention is required to augment groundwater resources in stressed areas. Irrigated agriculture in the state is putting additional stress on the groundwater system and needs proper management of the resources.

Central Ground Water Board is providing all technical input for effective management of ground water resources in the state. The groundwater scenario compiled on administrative divisions gives a better perspective for planning various ground water management measures by local administrative bodies. With this objective, Central Ground Water Board is publishing the revised groundwater information booklet for all the districts of the state.

I do appreciate the efforts of Dr. K.Md.Najeeb, Regional Director and his fleet of dedicated Scientists of South Western Region, Bangalore for bringing out this booklet. I am sure these brochures will provide a portrait of the groundwater resources in each district for planning effective management measures by the administrators, planners and the stake holders.

Dr. S. C. Dhiman

PREFACE

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 30 districts of Karnataka state, of which six of the districts fall under farmers' distress category.

The Kolar 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 S.S.Hegde, Scientist-C, Central Ground Water Board, South Western Region, Bangalore. The figures were prepared by Sri. J. Sivaramakrishnan, Assistant Hydrogeologist. The rainfall data provided by Shri H.P.Jayaprakash Scientist-C. 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.

sd/-

(Dr. K.Md.Najeeb)
Regional Director

CHAMARAJANAGAR DISTRICT AT A GLANCE

Sl.No.	Items	Statistics	
1	**General Information**		
	i) Geographical area (sq. km)	5,101	
	ii) Administrative Divisions	1	
	Number of Taluks	4 (Chamarajanagar Nagar, Kollegal, Gundlupet & Yalandur)	
	No. of Panchayat /Inhabited Villages :	120/424	
	iii) Population (As on 2011 Census)	1020962	
	iv) Annual normal rain fall (2001-2010)	737 mm	
2	**Geomorphology**		
	Major Physiographic Units	i). Southern maidan region, plain to undulating, mountainous. ii). The southern and eastern ghat ranges converging into group of hills. The principal hill ranges are B.R. hills, lofty mountains runs north south direction about 16 kms. MM hills with 77 hill ranges, and Gopalaswamy hill ranges etc., The highest peak of the district is in B.R.hills with1687m amsl. The average altitude of the district is 658.58m amsl.	
	Major Drainages	Drained by Cauvery river, which runs along the border of the Kollegal taluk in the district. Suvarnavathy and Chikkahole drain the rest of the area, which are the tributaries of the Cauvery.	
3	**Land use (ha)(2008-09)**		
	Forest area	275610	
	Net area sown	1,91,338	
4	**Major soil types**	i).Reddish brown forest soil ii).Yellowish grey to greyish sandy loam soils and iii). Mixed soils.	
5	**Area under principal crops (2008-2009) in ha**	**Crop** Paddy Ragi Jowar Bajra Maize **Others** **Total cereals** Gram Tur	**Area** 19294 20277 17922 479 41431 38 **99441** 3501 2349

		Total Pulses G. nut Sun flower Others **Total oil seeds** Sugar cane Tobacco Cotton Teak Horticulture crops & others	**5850** 16448 16866 00 **33314** 10931 161 443 52 55892
6	**Irrigation by different sources (ACSR 2008-09)** Dug wells Bore wells Tanks/ Ponds Canals Lift Other Sources	**Number** 3158 23349 155 8 6 **-**	**Area (ha)** 6562 38500 9112 12940 500 16
	Net Irrigated Area (ha)	**67630**	
7	**Number of ground water monitoring stations of CGWB (as on 31-03-2012)** Number Dug wells Number of Piezometers	 30 5	
8	**Predominant geological formations**	Granite, gneiss and charnockite. Recent alluvium of limited extent along the river courses.	
9	**Hydrogeology**		
	Major Water Bearing Formations -		
	Phreatic aquifer in alluvium along the stream courses and weathered zones of granite, gneiss, charnockite and occur between the depths of 2 to 20 m bgl.		
	Fractured aquifers at deeper levels below weathered zone occur in granite, gneiss and charnockite ,occur between the depths of 20 to – 165m bgl.		
	Pre-monsoon Water Levels during 2011	1.2 – 17.21 m bgl (general range 1 – 8 m bgl)	
	Post-monsoon Water Levels during 2011	0.2– 17.30 m bgl (general range 1 – 6 m bgl)	
	Long term water level trends (2001-2010) in m/year:	NHS (DUG WELLS)	Thirteen National Hydrograph Stations (NHS) water levels have shown rising trend in the range of .029 to 0.4 m/year, while at eight NH Stations water levels have recorded falling trend in the range of 0.003 to 0.588 m/year.

		NHS (Pizometers)	At four National Hydrograph Stations (Pizometers) water levels have shown rising trend in the range of 0.124 to 0.649 m/year, at one pizometer water level have shown falling trend with 1.038 m/year.
10	**Ground water exploration by C.G.W.B. (as on 31-03-2012)**		
	No of wells drilled		EW: 26, OW: 9, PZ: 5
	Depth range		77 – 201 m bgl
	Discharge		< 1 – 18 litres / second
	Transmissivity		07 – 228 m^2 / day
11.	**Ground water quality**		
	Presence of chemical constituent more than the permissible limit		Chemical quality of Ground water is suitable for all purposes in major parts of the district with low sodium type of ground water except in few pockets where Nitrate concentration is high (parts of C.R.nagar & Yalandur taluks) and F is high in eastern parts of Kollegal taluk.
	Type of water		Low sodium type
12.	**Dynamic Ground Water Resources** (ham) (March 2004)		
	Net Annual Ground Water Availability		34187 ham
	Existing gross Ground Water Draft for all use		24558 ham
	Projected demand for Domestic and Industrial uses up to 2025		2926 ham
	Stage of Ground Water development as on March 2009 (%)- District average		**72** : (61%in Chamarajanagar, 46 %in Kollegal taluk, 69 % in Yelandur and 134 % in Gundlupet taluk).
13.	**Awareness and Training Activity**		
	Mass Awareness Programmes Organised		1 at Kollegal
	Water Management Training Programmes organised:		1 at Chamarajanagar
14.	**Efforts of artificial recharge & rain water harvesting**		
	Projects completed by CGWB (No and amount spent)		Nil
	Projects under technical guidance of C.G.W.B (numbers)		Nil
15.	**Ground water control and regulation**		
	Number of OE Blocks Number of Critical blocks Number of blocks notified		Nil Nil Nil

16.	**Major ground water problems and issues**	Groundwater source depletion, quality deterioration due to pollution and water logging coupled with soil salinity are the major issues in the district. Groundwater development has reached nearly 72 % in the district. About 70% of the district area is under **safe** category, 23% under **over-exploited** and 7% under **semi-critical** category. Excess geogenic **fluoride** problem is observed in parts of Kollegal and few other isolated places. Higher **nitrate** problem due to agricultural activity is prevalent in canal command areas of Yalandur and Kollegal taluks. **Water logging** and soil salinity due to rise in groundwater level is a threat in canal command areas.

CHAMARAJANAGAR DISTRICT

1.0 Introduction

1.1 General

Chamarajanagar district is one of the 7 new districts formed during 1997 which is located in the extreme south end of Karnataka state. Being in the southern border, it links the State with Tamil Nadu and Kerala States. The district consists of 4 taluks,16 hoblies, 424 inhabited villages and 85 uninhabited villages.The four taluks of the district are Chamarajanagar, Gundlupet, Kollegala and Yelandur. The Chamarajanagar town is the district head quarters. The district is famous for sandalwood and other forest products. The district falls in Cauvery basin but, there are no perennial rivers draining the district. However, the river Cauvery flows along the boundary of Kollegala taluk. The district is mainly drained by Suvarnavathy and Chikkahole, which are the tributaries of Cauvery and are ephemeral in nature. There are no mineral based industries in the district. The district is industrially backward and is supported by agrarian economy. Quarrying of hard rocks is a major activity which are used for civil construction work, production of decorative polished slabs and as road material. The existence of rich forest helps the economy in various ways as it provides raw materials for industries like paper, rayon, saw mills, safety matches and sandalwood. Bandipura National Park having a large population of spotted deers and elephants is located in the district.

The total population in the district is around 10,20,962 (as per 2011 census), out of which 513359 are male and 507603 are female. Thus, the sex ratio in the district is 989 females for every 1000 males. The average literacy rate is 51%(2001 census). The district has a rich forest wealth. About 48% of the district area is under forest cover. The rural population constitutes about 85% and is mainly dependent on agriculture. The agriculture in the district heavily depends on monsoon. The Net sown area is 34% of the district out of which in 20% area crop is raised more than once. Irrigation facility is available only in 35% of the Net sown area which constitutes 12% of the district area. Among the different sources of irrigation like canals, tanks, wells and bore wells etc, irrigation by canals contributes 19%, tanks 13 % and wells and bore wells contribute 68%. This indicates that in irrigated agriculture the groundwater contribution is considerably high (68%) and the remaining is met by surface water. Krishnarajasagar Irrigation project is serving mainly in Yalandur and

parts of Kollegal taluks. In other areas surface water irrigation is provided through minor irrigation tanks.

1.2 Location

The geographical area of Chamarajanagar district is 5,101 $km^{2.}$. The district is located in the southern extreme of Karnataka State and lies between the North latitude 11^{O} 40' 58" and 12^{O} 06' 32" and East longitude 76^{O} 24' 14" and 77^{O} 46' 55" and falls in the southern dry agro-climatic zone. Topography is undulating and mountainous with north - south trending hill ranges of Western ghats. The district is elongated in east – west direction. Mandya, Bangalore and parts of district are in the north, Wynad district of Kerala and parts of Mysore district are in the west, Salem and Nilgiri districts of Tamil Nadu are in the south and Dharmapuri district of Tamilnadu is in the east.

1.3 Administrative set up

The district comprises four taluks namely Chamarajanagar, Gundlupet, Kollegal and Yalandur. Among the four taluks, Kollegal taluk is the largest having an area of 2789 sq. kms and Yalandur taluk is the smallest with an area of 266.34 sq.kms. Chamarajanagar town is the district headquarters and the district has one revenue sub-division. 16 hoblies, 424 inhabited villages and 85 uninhabited villages. The administrative set-up of the district is shown in Fig.1.

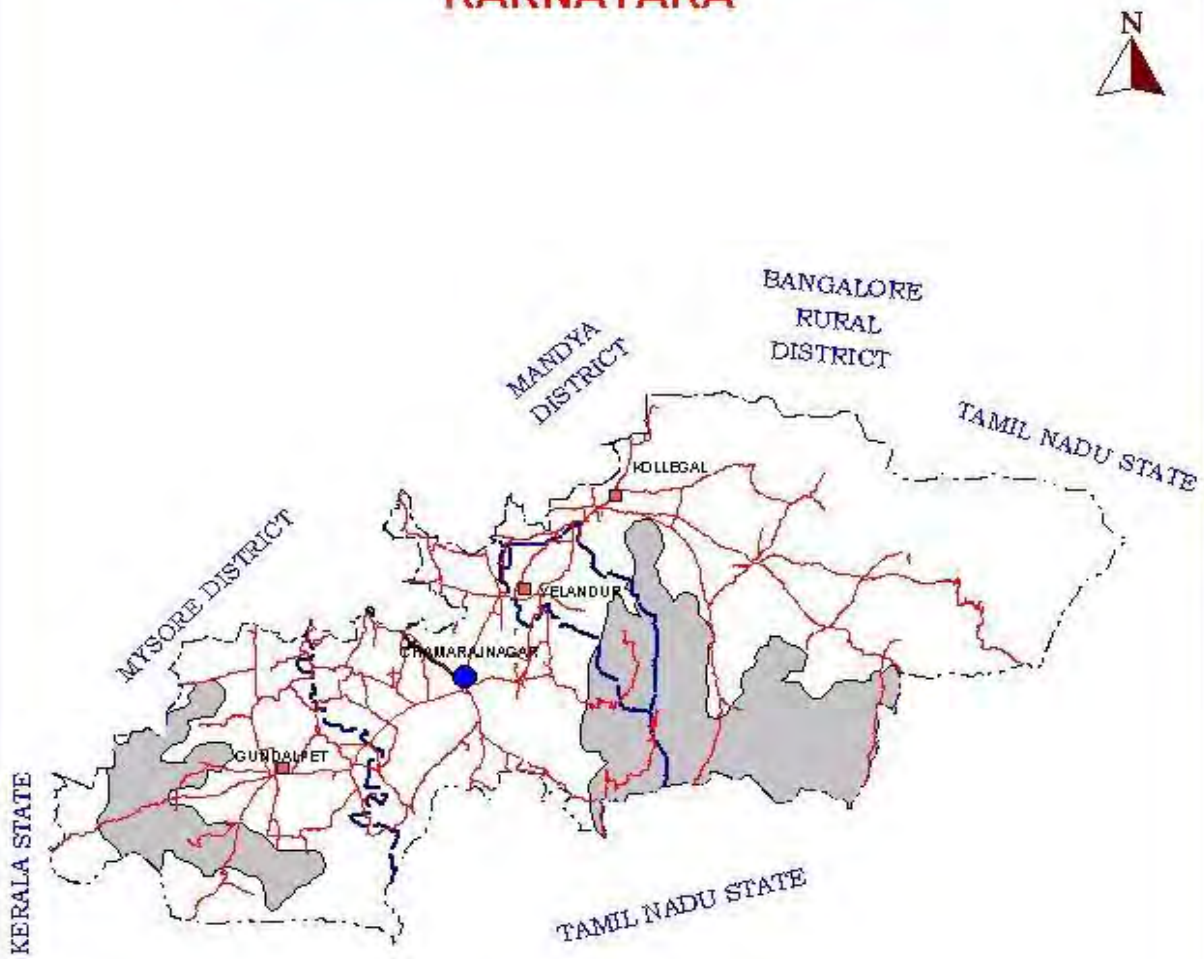
1.4 Communication

The district is well connected by highways and other main roads. The Bangalore – Nilgiris, Mysore-Mananthavadi National highways pass through the district in Gundlupet taluk. A fairly good network of roads exists connecting taluk headquarters with hoblis to various taluk headquarters. Total length 150 kms. of National Highway, 336.0 kms of State Highway and, 867.0 kms of other major district roads, 2612 kms length of village roads and other roads serve as road communication in the district. The Chamarajanagar is connected by Mysore-Chamarajanagar meter gauge railway line with a length of 18 kms.

1.5 Drainage

The district is in Cauvery river basin. There are no perennial rivers in the district, however, Cauvery, the perennial river flows along the border of Kollegal taluk of the district. The district is mainly drained by the tributaries of Cauvery like Suvarnavathy and Chikkahole and their tributary systems. Suvarnavathy rises near Gajjalahalli, southeastern portion of Chamarajanagar and flows in the depression along the center of the taluk in a north-south

ADMINISTRATIVE SET-UP
CHAMARAJANAGAR DISTRICT
KARNATAKA



LEGEND

- Metalled road
- National Highway
- Railway track
- Taluk boundary
- District headquarters
- Taluk headquarters
- Hilly area

direction and flowing through Yalandur taluk it joins the river Cauvery at Hampapura in Kollegal taluk. It has a catchment area of 1787 sq.km with total length of 88 kms in the district. The stream is ephemeral in nature and effluent upto Umbale village and influent to the rest of it's course. A dam has been constructed across Suvarnavathy at Atgulipura in Chamarajanagar taluk. The Chikkahole is a tributary of Suvarnavathy, which rises at Hasanur ghat range to the south of Chamarajanagar and flows in northerly direction. A dam is constructed across this tributary about 12 kms away from Chamarajanagar. Besides these, Gundal, Thattaihalla, Uduthore halla and Palar are the tributaries of Cauvery river which drain parts of Kollegala taluk. The area is characterized by sub-dendritic to sub-parallel drainage pattern. The drainage density varies from 0.25 to 3.58 km/km^2. The density decreases towards Suvarnavathy river. The drainage map of the district is presented in fig.2.

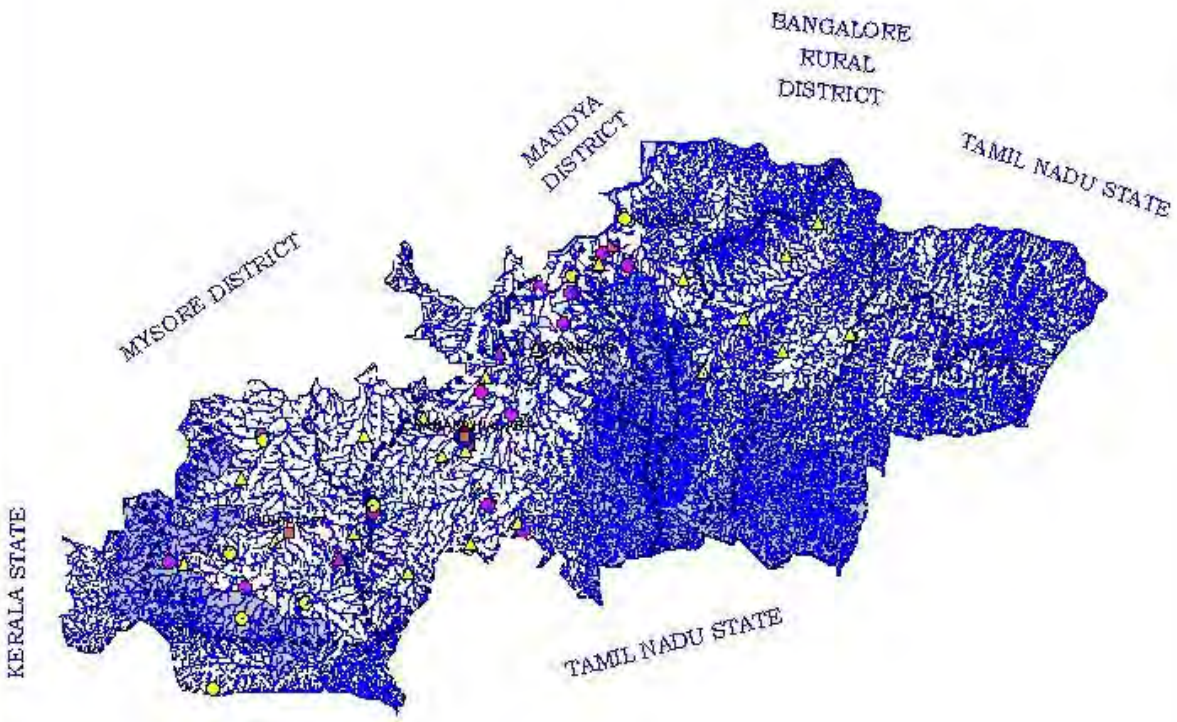
1.6 Crops and Irrigation Practices

The district falls in southern dry agro-climatic zone. Various agricultural and horticultural crops are grown in the district. Among the agricultural crops cereals (paddy,ragi, jowar and maize), pulses (gram, tur), oil seeds (groundnut, sunflower), cash crop (sugarcane) and non-food crops (cotton and tobacco) and vegetables are important. Mango, banana and mulberry are important horticultural crops. Sericulture is a traditional activity in the district. As per the Agricultural census 2005-06 data, The net sown area is 191838 hect which constitutes 34% of the geographical area of the district. In this, the marginal (< 1 hect) and the small (1-2 hect) land holdings comprise 59% and the semi-medium(2-4 hect) and the medium (4-10 hect) land holdings comprise 38%. Irrigation facility is available in 35% of the Net sown area which constitutes 12% of the district area. Among the different sources of irrigation like canals, tanks, wells and bore wells etc, irrigation by canals covers 19%, tanks 13% and wells and bore wells contribute 68%. Thus, in irrigated agriculture, the groundwater contribution is considerably high (68%) compared to the surface water surface water (32%). As per the census records(Fourth census od MI schemes 2006-07), the district has 22307 minor irrigation structures, of which 3158 are dugwells, 22849 tube wells, 166 surface water flow schemes and 6 lift irrigation schemes.

1.7 Activities carried out by CGWB

Central Ground Water Board has carried out Systematic Hydrogeological surveys, Reappraisal Hydrogeological surveys and Groundwater Exploration in the district The hydrogeological investigations and groundwater exploration have revealed the

DRAINAGE & HYDROGRAPH MONITORING STATIONS
CHAMARAJANAGAR DISTRICT, KARNATAKA



LEGEND

CGWB STATIONS

- Dug well
- Piezometer

DMG STATIONS

- Dug well
- Piezometer
- Surface waterbody
- Drainage
- Watershed Boundary

existence of potential zones down to the depth of 200 m. First phase of groundwater exploration down to adepth of 90 m in the district (except Kollegal) was carried out during 1990's and second phase down to a depth of 200m has been going on since 2008. Total 5 number of purpose built piezometers are constructed under Hydrology Project programme for groundwater water level monitoring in which automatic water level indicators are installed. Besides, Central Ground Water Board maintains a good network of observation dug wells (NHS) in the district, which are monitored periodically to keep a close vigil on groundwater water level and water quality.

2.0 Climate and Rainfall

The climate of Chamarajanagar district is quite moderate through out the year with a fairly hot summer and cold winter. March to May are the summer months. The mean maximum temperature is 34°C and the mean minimum temperature is 16.4°C. Relative humidity ranges from 69 to 85% in the morning and from 21% to 70% in the evening. The wind speed ranges from 8.4 to 14.1 kmph. The potential evapo-transpiration in the district ranges from 106 mm to 165 mm/year.

The average annual rainfall of the district (2001-2010, DES, Govt of Karnataka) is 737mm (Table. 1). The highest rainfall is received in Gundlupet taluk (802 mm) followed by Yalandur (737 mm), Kollegal (712mm) and Chamarajanagar (696mm) taluks. Except Gundlupet taluk, in others the amount of rainfall is more or less similar. About 37% of the annual rainfall is received during the SW monsoon (June – September), 36% during post-monsoon or NE monsoon (October – December) and the remaining 27% during the pre-monsoon (January- May) period. The analysis of rainfall for the above period indicates that though the SW monsoon is more predominant, substantial rainfall is received during the post-monsoon or NE monsoon period. The average annual rainy days are 54 (District at a Glance 2008-09).Thus, it can be seen that a fairly uniform distribution rainfall during different seasons and good number of rainy days will help the rain fed agriculture in the district.

Table 1. Normal rainfall of Chamarajanagar district, (2001-2010)

*Rain fall in mm						**Av. Annual rainy days
Sl.No.	Station	Pre-monsoon	SW monsoon	Post-monsoon	Total	
1	Chamarajanagar	178	275	243	656	59
2	Gundlupet	236	253	313	802	55
3	Kollegal	175	294	243	712	46
4	Yelandur	202	273	262	737	54
	Av.	198	274	265	737	54

Source: * Department of Statistics & Economics, Govt of Karnataka
** District at Glance, Chamarajanagar, 2008-09, Govt of Karnataka

3.0 Geomorphology and Soil Types

Physiographically the district may be classified as partly maidan, general table land with plain and undulating and mountainous region. The southern and eastern hill ranges in the district converge into group of hills. The landmass of the area forms an undulating table land and the lofty mountain ranges are covered with dense forest. Master slope runs from south to north towards the river Cauvery. Normally the slopes are covered by debris and colluvium filled channels. The general elevation is 656 m amsl. The eastern and southern portions of Kollegal taluk form continuous lofty hills such as Malaimahadeshwar Hills (M.M. Hills) with an elevation of 976m amsl and many other hill ranges such as Anemale, Kadumale, Jenumale, etc. Dodda sampige is another hill range which runs north to south for 6 kms in Kollegal taluk. Biligirirangana betta in Yalandur taluk, Gopalaswamy hills in Gundlupet also form the hill ranges in the district. The Shivanasamudra island and Edacura village towards north of Kollegal taluk form important features formed due to meandering and confluence of Cauvery river. The soils of the district are derived from Granitic gneisses and Charnockite rock formations. Red soil is present in upland areas and at the contact of granites and schist. These soils are admixture of sand and silt. Organic matters in these soils are low and respond well for irrigation, manuring and other management practices. The thickness of the soil varies from less than a meter to 6.5 m. Black soils are clayey and black in colour, mostly of transported origin, occurring along depressions where regular irrigation practices are in practice. It has a high moisture holding capacity. Mixed type of soils are localised at places along the contact of schist and other intrusions. These are derived either from gneisses or schist. These are medium to fine grained and moderately permeable. The thickness varies from 1m to 16.5m.

4.0 Ground water scenario

4.1 Geology

The Chamarajanagar district is a hard rock terrain comprising peninsular gneiss, charnockites and limited extent of alluvium restricted mainly to sides of river courses. Among these, charnockite is the wide spread formation in the district covering parts Chamarajanagar, Kollegal and Yalandur taluks. Gneissic formation is found in Gundlupet taluk, parts of Chamarajanagar and Yalandur taluks. Alluvium of limited aerial extent and thickness is occurring along the major tributaries of Cauvery river like Suvarnavathy and Chikkahole. The valley fill area extends to very limited stretch with an average thickness of 6 to 18.00 m.

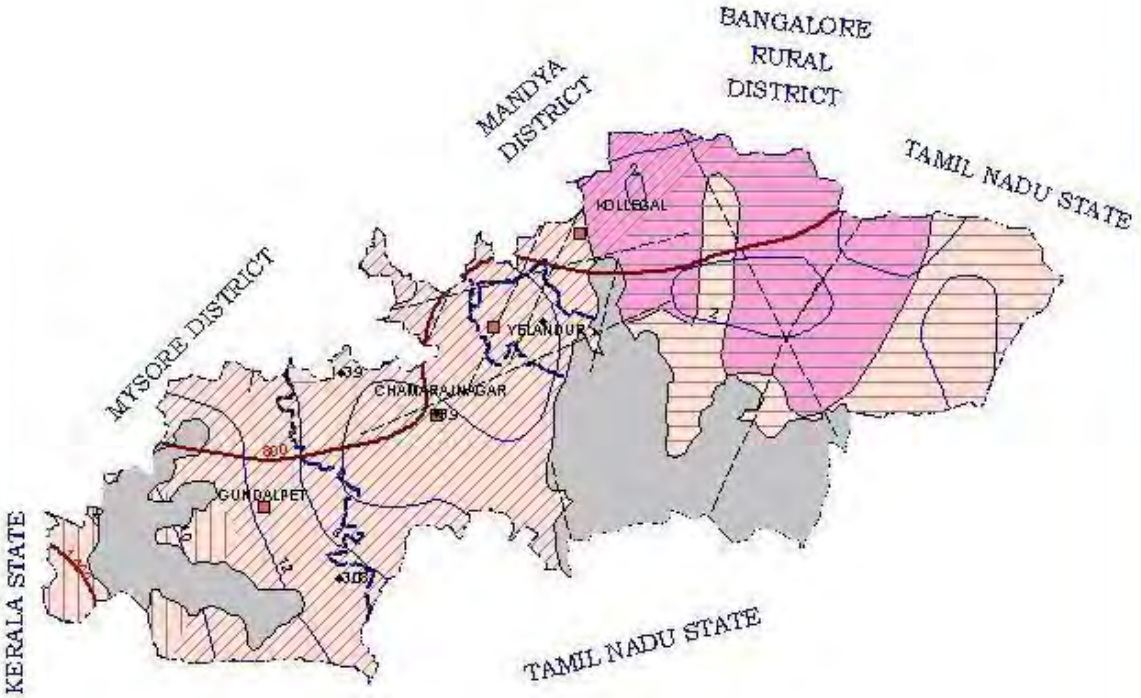
4.1.1 Hydrogeology

The principal crystalline rocks as stated above have no primary porosity. Hence, the water bearing and yielding properties are primarily due to the development of secondary porosities like weathering, joints, fractures and fissures. The thickness of weathered zone generally from to 5.00 m to 35.0m. Groundwater occurs under phreatic (unconfined/water table) condition in weathered zone and alluvium. The alluvium forms a good shallow aquifer system along the river courses. Best example is near Sathegala in Kollegal taluk where number of filter points exists. Groundwater occurs under semi-confined to confined conditions in fractured crystalline gneisses and charnockites. Groundwater exploration has proved the existence of potential fractured aquifers below weathered zone at various depths down to 165 mbgl. The principal source of recharge is rainfall. In canal command areas like parts of Yalandur and Kollegal taluks seepage from canal and percolation from applied irrigation water forms additional source of recharge. The hydrogeological details of the area are presented in the figure-3

4.1.2 Depth to water level

There are sixteen National Hydrograph Stations (NHS – dug wells and shallow bore wells) in Chamarajanagar district which are regularly monitored for knowing periodical changes in ground water level and the quality of water. The depth to water levels ranges from 0.38 mbgl to 17.21 mbgl during pre-monsoon period (May-2011) and from 0.20 mbgl to 17.30m bgl during the post-monsoon period (November 2011). But, generally the depth to water level ranges between 2 m bgl

HYDROGEOLOGY
CHAMARAJANAGAR DISTRICT
KARNATAKA



LEGEND

Geology

- Granites
- Gneisses

Ground Water Prospects

- Yield upto 1 litres per second
- Yield upto 5 litres per second
- Yield >5 litres per second
- 39 Borewell with Yield in litres per second

- Lineament
- 1000mm Isohyet
- 2 Decadal mean water level in m bgl
- Taluk boundary
- Taluk headquarters
- Hilly area

and 10.0m bgl and shallow water levels of less than 2m bgl are observed in canal irrigation area of Yalandur and Kollegal taluks. The pre-monsoon and post-monsoon depth to water levels are depicted in figure - 4 and figure - 5 respectively.

4.1.3 Seasonal water level fluctuation

In response to recharge from rainfall and other sources like canal seepage and applied irrigation, there will be a rise in water level during SW monsoon (June – September) as compared to the pre-monsoon period.During post monsoon period recharge reduces and groundwater level reduces due to withdrawal for different uses. Thus, the difference in water levels between pre-monsoon (May) and the post-monsoon(November) is termed as annual fluctuation. The seasonal water level fluctuation for the year 2011 (Water level difference between May 2011 and Nov 2011) is available for 16 National Hydrograph network Stations. More than 80% of the wells in the district have shown a rise in ranging from 0.54m to 6.75m. The remaining wells have recorded a fall in the range of 0.10m to 0.53m.

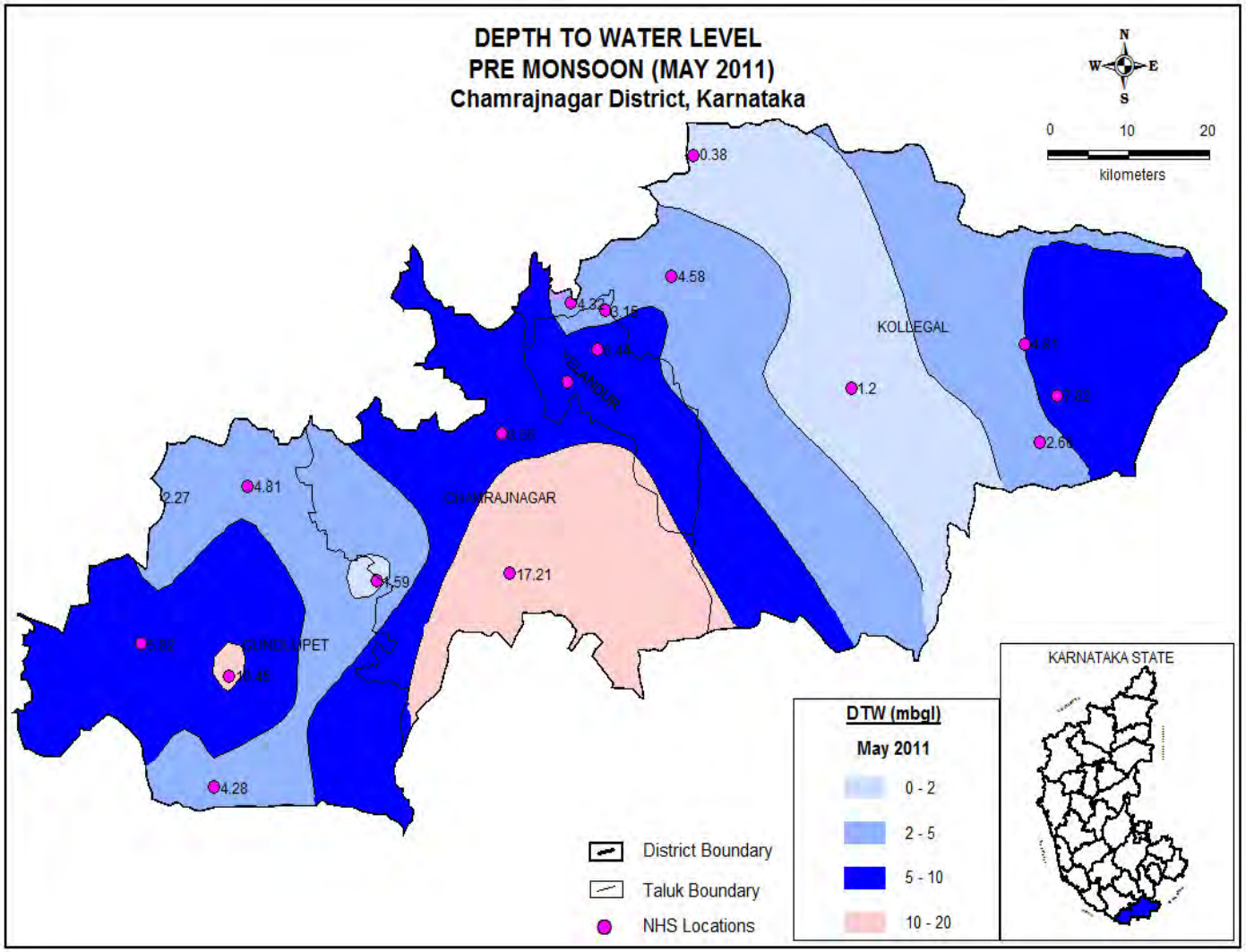
4.1.4 Long-term water level trend

The long term (decadal) water level trend of the pre-monsoon (May 2001-May 2010) as well as post-monsoon have been analyzed for 23 NH Stations for the period from 2001 to 2010. During the pre-monsoon, the decadal trend reveals that 13 stations have shown rising trend in the range of 0.029 m/year to 0.40 m/yr and the remaining 4 stations have recorded a fall in the range of 0.02 m/year and 0.04 m/year (fig.6). Except the eastern part of Kollegal taluk, there is a rise in water level in the district during the pre-monsoon period. During the post-monsoon period, the decadal trend reveals that 10 stations have shown rising trend in the range of 0.027 m/year to 0.61 m/yr and the remaining 9 stations have recorded a fall in the range of 0.1 m/year and 0.284 m/year(fig. 7). Except the western part of Gundlupet taluk, there is declining trend in the decadal ground water level in the district during the post-monsoon period.

4.1.5 Aquifer systems encountered in the area

The study of aquifer geometry and parameters have been attempted by Central Ground Water Board, South Western Region, Bangalore, under its ground water exploration programme through drilling exploratory bore wells at selected places. First phase of groundwater exploration down to a depth of 90 m in the district (except

Fig: 4


DEPTH TO WATER LEVEL
PRE MONSOON (MAY 2011)
Chamrajnagar District, Karnataka
N
W
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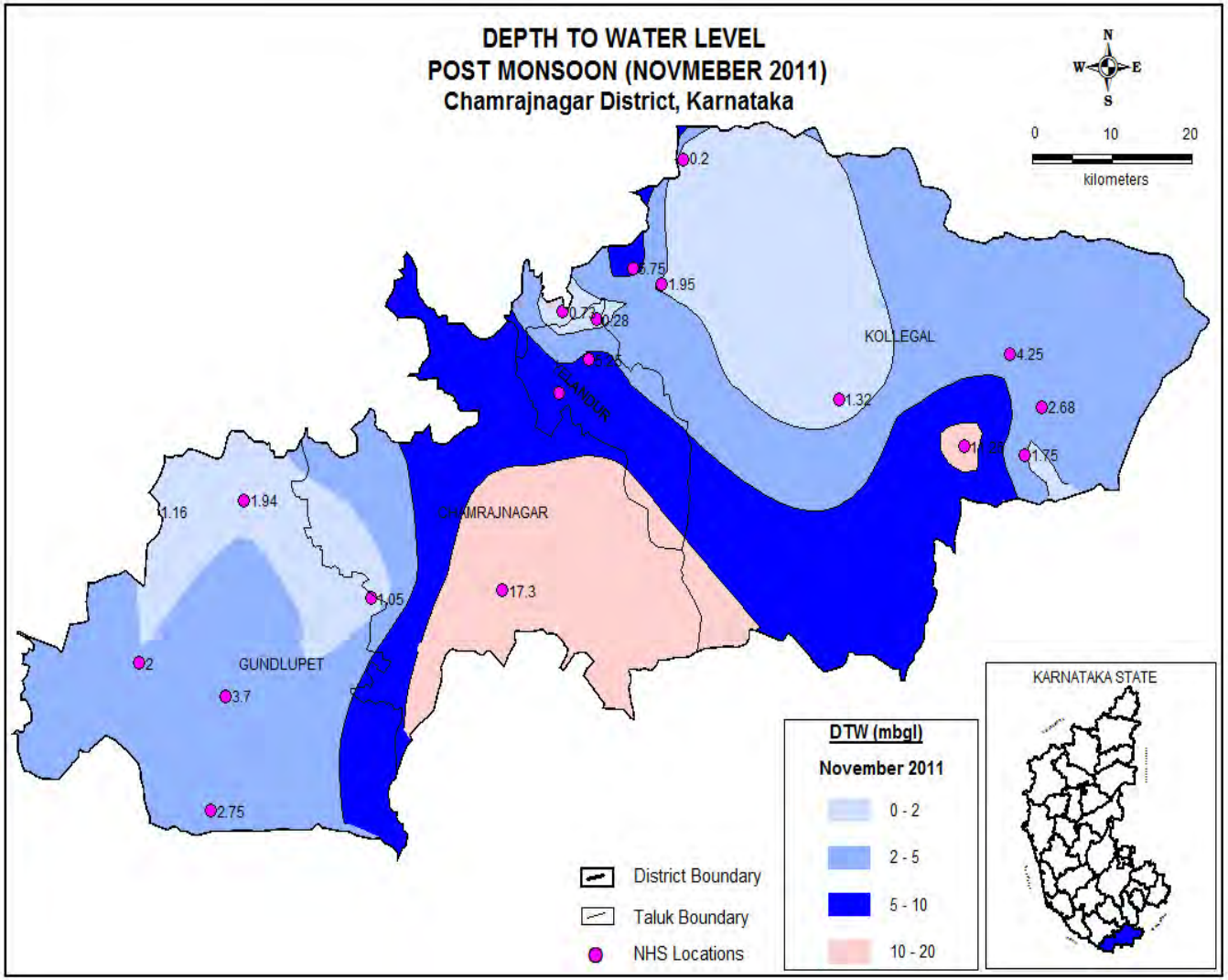
0
10
20
kilometers
0.38
4.58
4.22
3.15
3.44
KOLLEGAL
4.81
1.2
7.82
2.68
CHAMRAJNAGAR
17.21
4.81
2.27
1.59
5.82
GUNDLUPET
4.28
DTW (mbgl)
May 2011
0 - 2
2 - 5
5 - 10
10 - 20
District Boundary
Taluk Boundary
NHS Locations
KARNATAKA STATE

Fig.5


DEPTH TO WATER LEVEL
POST MONSOON (NOVMEBER 2011)
Chamrajnagar District, Karnataka
N
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0
10
20
kilometers
0.2
0.75
1.95
0.28
KOLLEGAL
4.25
1.32
2.68
1.75
1.94
1.16
CHAMRAJNAGAR
17.3
1.05
2
GUNDLUPET
3.7
2.75
District Boundary
Taluk Boundary
NHS Locations
DTW (mbgl)
November 2011
0 - 2
2 - 5
5 - 10
10 - 20
KARNATAKA STATE

Fig.6

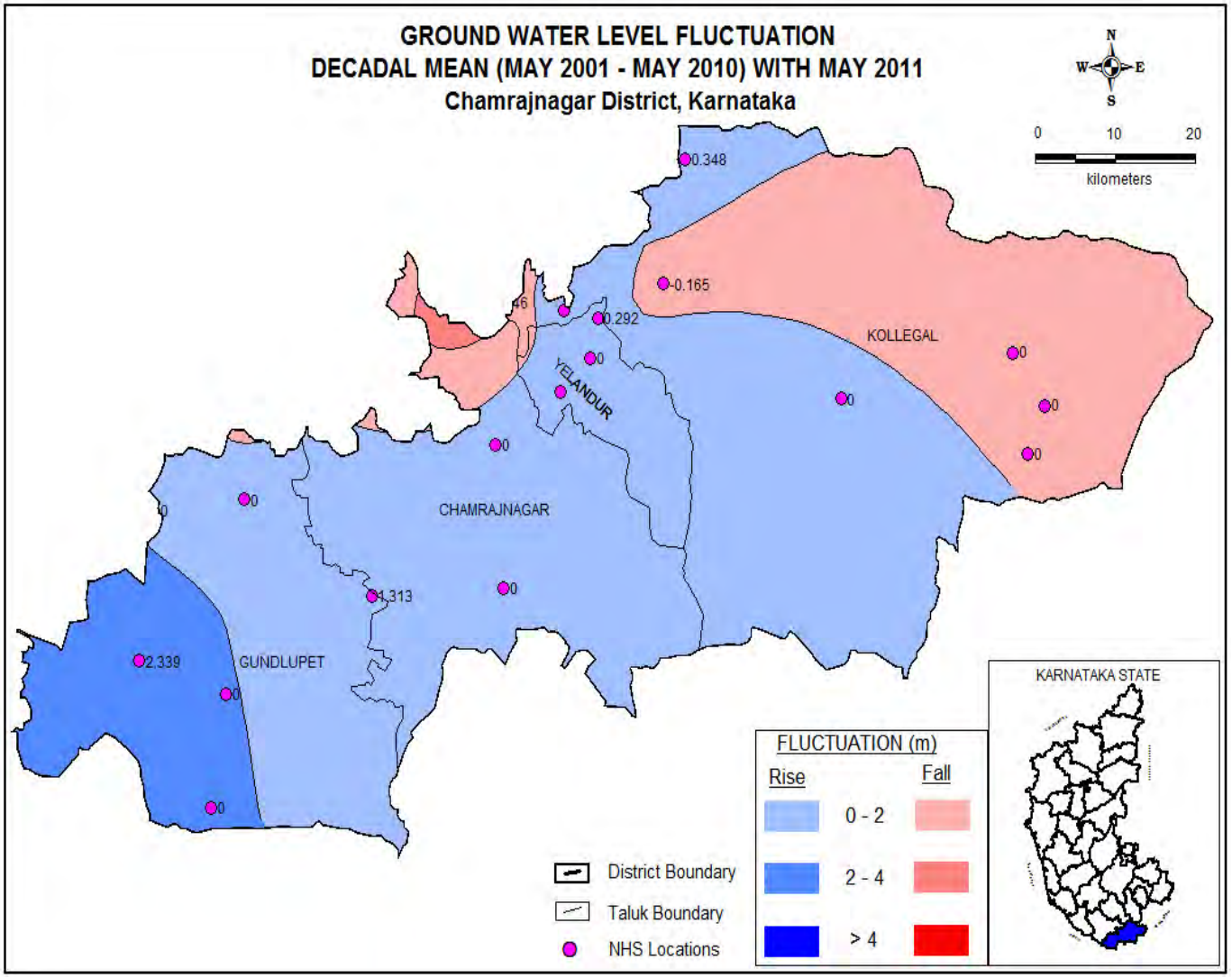
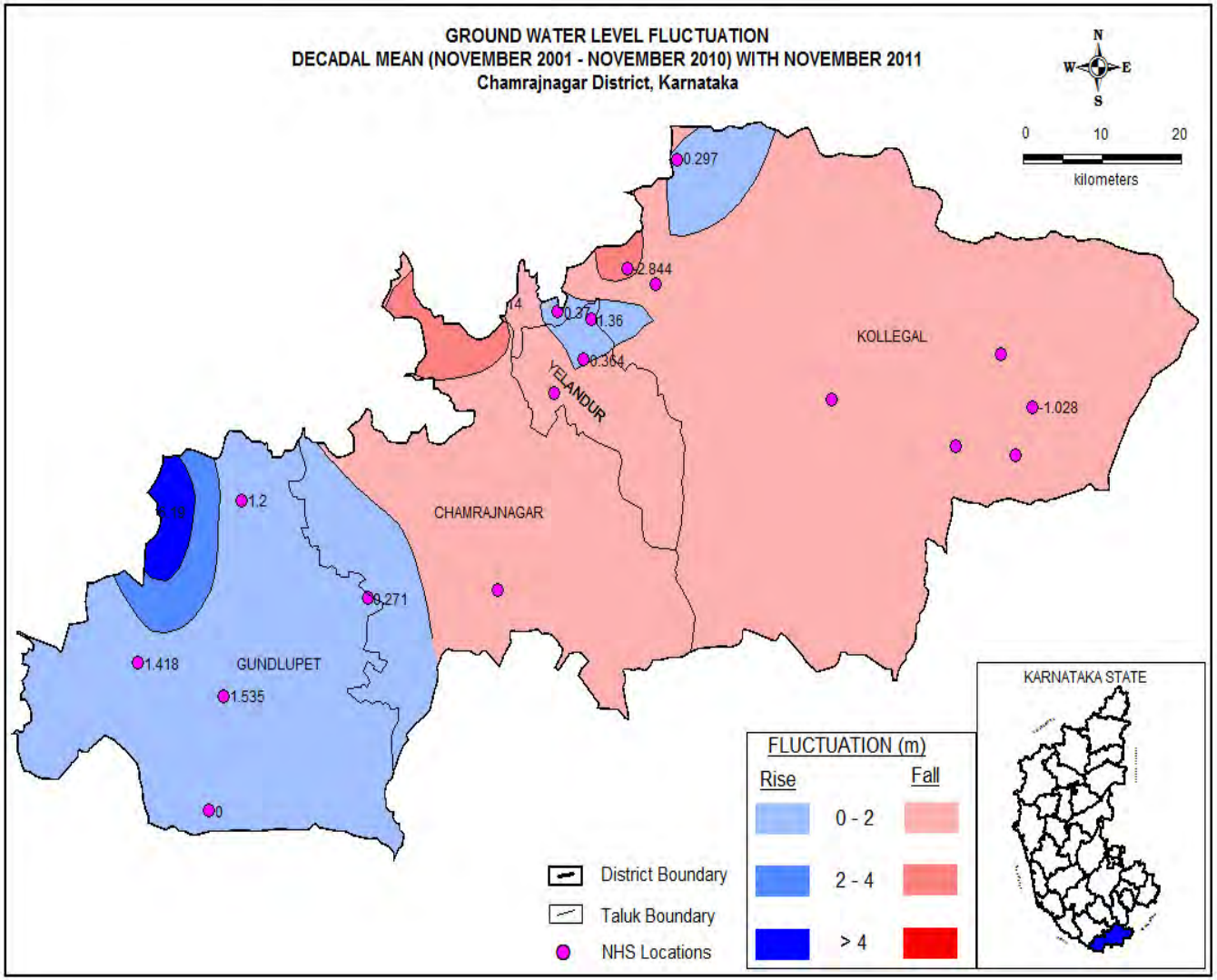

GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (MAY 2001 - MAY 2010) WITH MAY 2011
Chamrajnagar District, Karnataka
N
W
E
S
0
10
20
kilometers
0.348
-0.165
0.292
KOLLEGAL
YELANDUR
CHAMRAJNAGAR
GUNDLUPET
2.339
1.313
KARNATAKA STATE
FLUCTUATION (m)
Rise
Fall
0 - 2
2 - 4
> 4
District Boundary
Taluk Boundary
NHS Locations

Fig.7


GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (NOVEMBER 2001 - NOVEMBER 2010) WITH NOVEMBER 2011
Chamrajnagar District, Karnataka
N
W
E
S
0
10
20
kilometers
0.297
2.844
1.36
0.364
YELANDUR
KOLLEGAL
-1.028
CHAMRAJNAGAR
1.2
0.271
1.418
GUNDLUPET
1.535
0
KARNATAKA STATE
FLUCTUATION (m)
Rise
Fall
0 - 2
2 - 4
> 4
District Boundary
Taluk Boundary
NHS Locations

Kollegal) was carried out during 1990's and second phase down to a depth of 200m has been going on since 2008. In the second phase, so far 26 exploratory wells and 09 observation wells have been drilled in the district. The thickness of weathered zone ranges from 12 to 35m. In this zone groundwater occurs under unconfined condition tapped mainly through dug wells. Potential fractured aquifers are encountered between 18 m and 165m bgl where groundwater occurs under semi-confined to confined conditions. These fractured aquifers are tapped through bore wells. Discharge ranges from <1.0 to 6 lps. Pumping tests on these wells show that transmissivity of aquifer in general ranges from 3 to 622 m^2/day. Locations of exploratory wells are given in figure – 8.

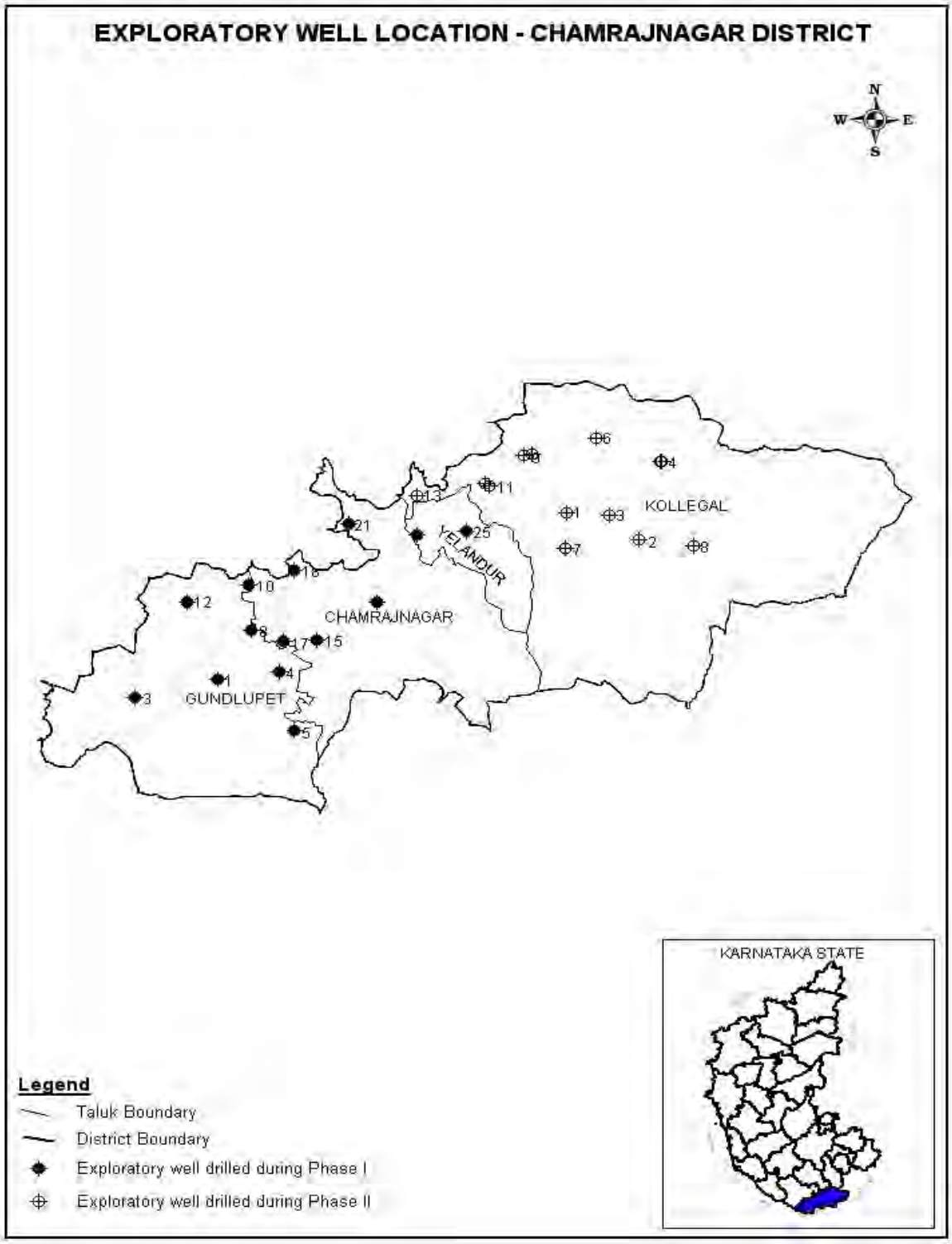
4.2 Ground water resources

Dynamic Ground Water Resource of Chamarajanagar district is estimated taluk wise as on 31st March 2009. The Net annual ground water availability in the district is 34187 ham and the Gross ground water draft for all uses is 24558 ham. The Ground water availability for future irrigation development is 12740 ham. The average Stage of Groundwater Development of the district is 72%. Taluk wise data viz. net ground water availability, existing ground water draft for irrigation, existing gross groundwater draft for domestic and industrial water supply, allocation for domestic and industrial use for next 25 years, net ground water availability for future irrigation development, categorisation etc, are shown in the table – 2 and depicted in figure 9.

Table-2 Taluk-wise groundwater resource of Chamarajanagar district (March 2009)

Taluk	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 use for next 25 years	Net ground water availability for future irrigation development	Stage of GW development	Stage of ground water development (%)			
								Safe (%)	Semi-critical (%)	Critical (%)	OE (%)
	HAM	HAM	HAM	HAM	HAM	HAM	%	%	%	%	%
CR NAGAR	10831	6062	589	6651	905	3863	61	97	03	-	-
GUNDLUPET	7553	9235	857	10092	929	1018	134	50	25	-	25
KOLLEGAL	13412	5617	557	6174	764	7286	46	65	-	-	35
YELANDUR	2391	1490	151	1641	328	573	69	100	-	-	-
TOTAL	**34187**	**22404**	**2154**	**24558**	**2926**	**12740**	**-**	**-**	**-**	**-**	**-**

Fig.8


EXPLORATORY WELL LOCATION - CHAMRAJNAGAR DISTRICT
N
W
E
S
KOLLEGAL
YELANDUR
CHAMRAJNAGAR
GUNDLUPET
KARNATAKA STATE
Legend
Taluk Boundary
District Boundary
Exploratory well drilled during Phase I
Exploratory well drilled during Phase II

The Stage of groundwater is the highest in Gundlupet taluk (134%) and the lowest in Kollegal taluk (46%). A moderate development has taken place in Chamarajanagar (61%) and Yalandur (69%) taluks. Categorisation of each taluk area has been done on the basis of Stage of development and the long term trend of water level fluctuation. Thus, the categorization of the taluks indicates that the entire Yalandur taluk falls under **safe** category and in Chamarajanagar taluk 97% area falls in **safe** category, where there is enough scope for further ground water development. In Kollegal taluk 65% area falls in **safe** category and in Gundlupet taluk 50% of the area falls in **Safe** category. In these taluks, considerable parts of the area fall in **Over-Exploited** (35% in Kollegal taluk and 25% in Gundlupet taluk) category. Thus, it can be seen that about 70% of the district area is under Safe, 7% under Semi- critical and 23% is under Over-exploited category. In over-exploited area future groundwater development should be taken up cautiously with adopting proper management practices for avoiding further deterioration of the resource. Taluk wise Status of groundwater utilization is presented in figure – 9.

4.3 Ground water quality

The water samples from NH Stations (2007) were analysed to decipher the shallow aquifer water quality. The results indicate that the water is alkaline in nature with pH value ranging from8.3 to8.9.The range of other important parameters / contents are- EC ranges from 850 to 1770micromhos/cm at 25 °C; Carbonate from 12 to 27 ppm; Bicarbonate from 250 to 336 ppm; Chloride from 78 to 490 ppm, Calcium from 24 to44; Magnesium from 10 to 24 ppm;Sodium from 91 to 300 ppm Sulphate from 30 to 48ppm and Nitrate from 9 to 143 ppm. Groundwaters from most of the area are potable and suitable for domestic and irrigational purposes except few exceptions.Excess of Nitrate and chloride contents are noticed in a few pockets in Chamarajanagar and Yalandur taluks, which is probably due to intensive irrigational activities in the command areas utilizing nitrogenous chemical fertilizers. The Nitrate concentrations in some places is beyond 100 ppm. Similarly, fluoride concentrations beyond 1.5ppm is observed in the eastern parts of Kollegal taluk which is geogenic.. The ground water quality of the district is presented in the figure-10.

Fig.9

STATUS OF GROUNDWATER UTILISATION
CHAMRAJNAGAR DISTRICT
(As on March 2009)

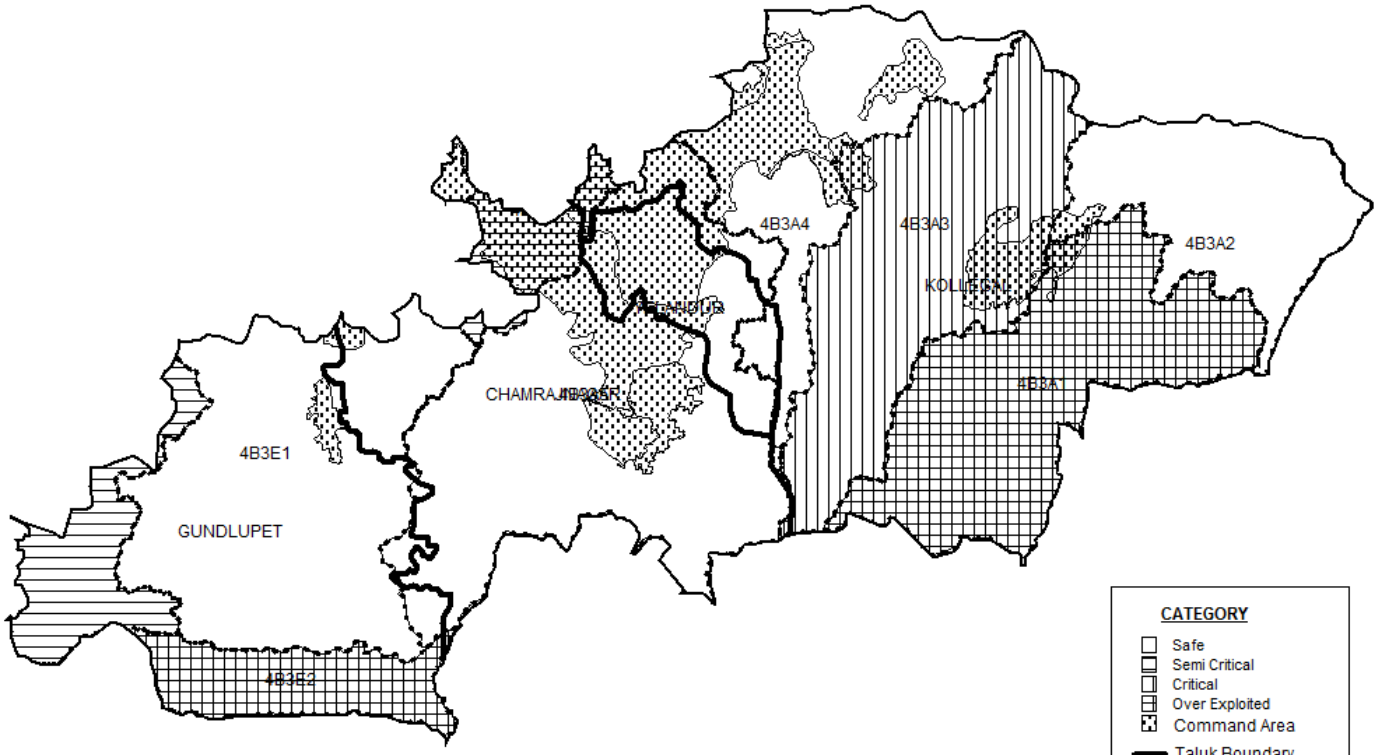
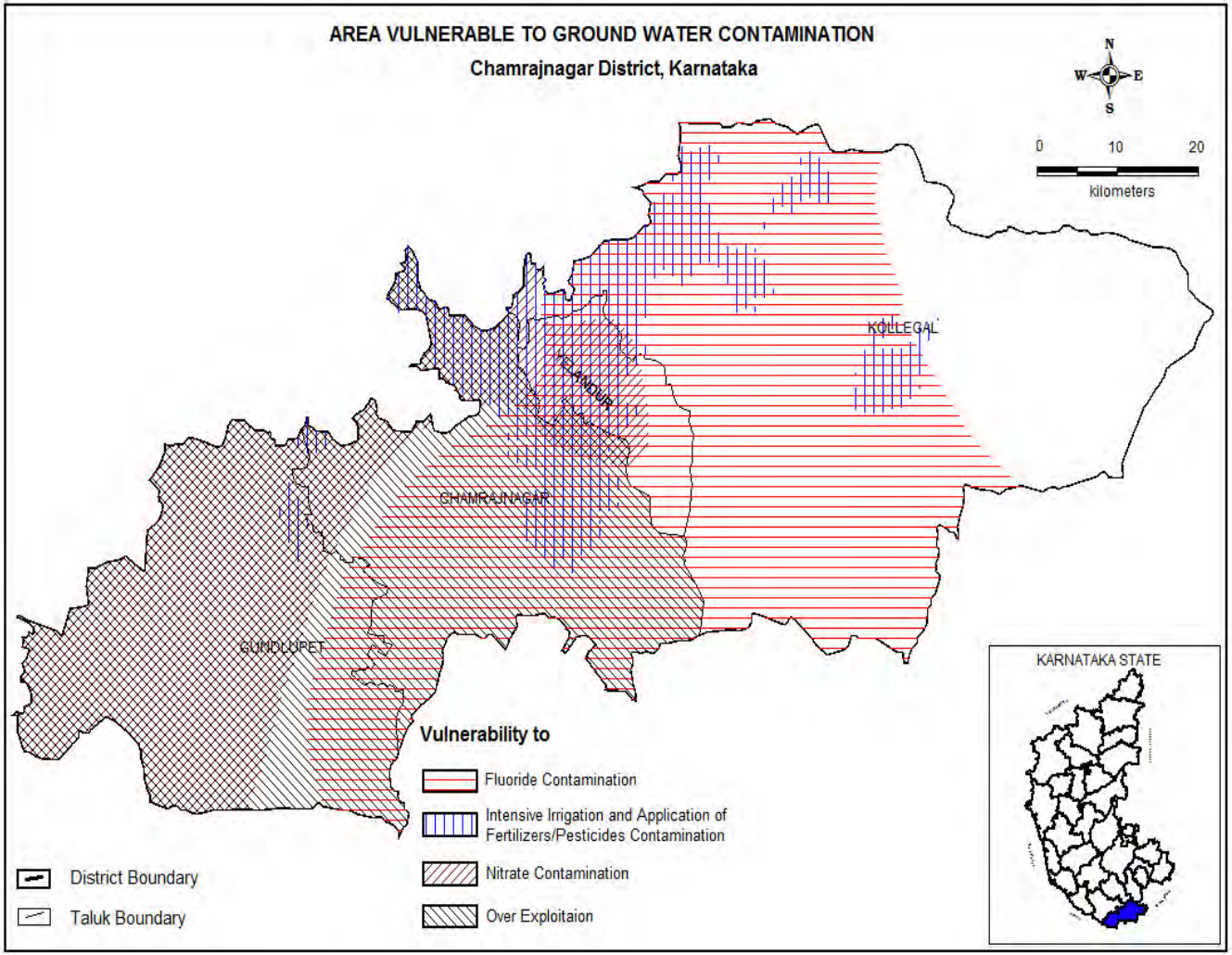


Fig 10


AREA VULNERABLE TO GROUND WATER CONTAMINATION
Chamrajnagar District, Karnataka
N
W
E
S
0
10
20
kilometers
KOLLEGAL
CHAMRAJNAGAR
GUNDLUPET
KARNATAKA STATE
Vulnerability to
Fluoride Contamination
Intensive Irrigation and Application of Fertilizers/Pesticides Contamination
Nitrate Contamination
Over Exploitaion
District Boundary
Taluk Boundary

4.4 Status of ground water development

4.4.1 Chamarajanagar taluk

Area of the Chamarajanagar taluk is 1226.67 sq.km. The area is underlain by hard, gneiss and charnockites. About 22% of the area of the taluk is covered by forest. Net sown area is 58735 hect constituting about 48% of the total area. The Net Irrigated area is 37% of the Net sown area. Groundwater is the major source of irrigation contributing nearly 80%. Canal irrigation from KRS project (Cauvery river) covers about 13% of the irrigated area. Groundwater is the main source of drinking water in major part of the taluk and surface water supplements the drinking water needs in the canal coverage area. There are 9720 irrigation bore wells and 175 irrigation dug wells. Sprinkler and Drip irrigation methods are being increasingly adopted to manage the water resources in agriculture sector.

The stage of ground water development 61% as against the district average of 72%. Thus, 97% of the area in the taluk is under **Safe** category and **the** remaining 3% area is under **Semi-Critical** category**.** Shallow zone ground water can be developed for irrigation through dugwells in topographic lows and through shallow/deep bore wells in the other areas. Under second phase of groundwater exploration programme 9 bore wells (6 exploratory wells & 3 Observation wells) borewells drilled which range in depth from 104m to 201 m. Potential fractured aquifers are encountered between 18 m and 165m depth with yields of less than 1 lps to 6.12 lps. Scientifically selected bore well sites in the taluk can help the farmers in getting a good yield.

4.4.2 Gundlupet Taluk

Area of the Gundlupet taluk is 1392.88 sq.km. The area is underlain by hard, gnessic formation. About 32 % of the area of the taluk is covered by forest. Net sown area is 57440 hectares constituting about 41 % of the total area. The Net Irrigated area is 17.6% of the Net sown area. There is no surface water irrigation facility in the taluk and groundwater is the sole source for the domestic and irrigation sectors.

Groundwater for irrigation in agriculture sector is developed through 7275 bore wells and 75 dug wells. The ground water thus developed are utilized for irrigation by

adopting different efficient water use irrigation practices such as sprinklers irrigations and drip irrigations.

The stage of ground water development in Gundlupet taluk is the highest in the district. A high development of 134 % has resulted in the desaturation of phreatic zone keeping no scope for further development of the resource. The pace of development is not uniform throughout the taluk. Though the over all stage of groundwater development is high, only 25% of the taluk area is under **Over-exploited** category and 25% is under **Semi-critical** and the remaining 25% under **Safe** category. However, further ground water development can be done through by developing deeper aquifers. Under second phase of groundwater exploration programme 10 bore wells (8 exploratory wells & 2 Observation wells) have been drilled which range in depth from 103 m to 153.5 m. Potential fractured aquifers are encountered between 36 m and 151 m depth with yields of less than 1 lps to 10 lps. Scientifically selected bore well sites in the taluk can help the farmers in getting a good yield.

4.4.3 Yalandur Taluk

Yalandur taluk is the smallest taluk in Chamarajanagar district with an area of 266.34 sq.km. The area is underlain by hard, gneiss and charnockite formations. About 40 % of the area of the taluk is covered by forest. Net sown area is 9471 hect constituting about 36 % of the total area. The entire net sown area is under irrigation. The Net Irrigated area is 17.6% of the Net sown area. Canal irrigation from KRS project (Cauvery river) covers about 39 % of the irrigated area and nearly an equal area (36%) is under ground water irrigation. The remaining area is irrigated by MI tanks and other sources.

Groundwater for irrigation in agriculture sector is developed through 1221bore wells and 338 dug wells. Groundwater development is low as canal water is made available for irrigation. The ground water thus developed are utilized for irrigation by adopting different efficient water use irrigation practices such as sprinklers irrigations and drip irrigations.

The stage of ground water development in Yalandur taluk is 69% which is a little lesser than the district average of 72 %. The entire taluk area is under **Safe** category indicating a further scope for the development of Dynamic groundwater resource.

4.4.4. Kollegal Taluk

Kollegal is the largest taluk in Chamarajanagar district with an area of 2785.82 sq.km. The area is underlain by hard, charnockite and gnessic formations. The taluk is almost hilly with a forest cover spread over about 69 % of the area. Net sown area is 66192 Hect constituting about 24 % of the total area. The Net Irrigated area is 39 % of the Net sown area. Groundwater is the major source of irrigation (54%) followed by Canal irrigation (24%) from KRS project (Cauvery river).

Groundwater for irrigation in agriculture sector is developed through 4632 bore wells and 2570 dug wells. Groundwater development is low as canal water is made available for irrigation. The ground water thus developed are utilized for irrigation by adopting different efficient water use irrigation practices such as sprinklers irrigations and drip irrigations. For irrigation, dug wells are common abstraction structures in canal command areas of the taluk which are supplementing irrigation during water shortage during summer months. As the major part of the taluk is hilly and covered by forest, groundwater development is low. There is enough scope for further ground water development in the taluk.

.

The stage of ground Dynamic water development in Kollegal taluk is 46% which is the least in the district. But, the groundwater development is not uniform in the taluk and therefore, some areas have witnessed a very high development and are classified as Over- exploited. Accordingly, 65% of the area falling in the northern part is under **Safe** category and the remaining 35% area in the southern part is classified as **Over-exploited**. There is further scope for developing dynamic groundwater resource in the northern (**Safe** category) part of the taluk. Under second phase of groundwater exploration programme 13 bore wells (10 exploratory wells & 3 Observation wells) have been drilled which range in depth from 104 m to 201 m. Potential fractured aquifers are encountered between 18 m and 165m depth with yields of less than 1 lps to 6.12 lps. Scientifically selected bore well sites in the taluk can help the farmers in getting a good yield.

5.0 Ground water management strategy

The Chamarajanagar district located in the southern tip of Karnataka is mainly a hilly area with 48% forest coverage. With an average rainfall of 737mm, the district is chronically drought prone. Further, due to the undulating topography percolation is poor and considerable rainfall runoff leaves the area unutilized. Therefore, Watershed treatment can help in augmenting the ground water resources. The areas where the artificial recharge structures are not feasible and rainfall is more, the available base flow in the streams and rivers during non-monsoon season may be arrested through construction of vented dams at suitable sites, which can be used either for water supply or for irrigation purposes. The net sown area comprises 34% of the total geographical area. The contribution of ground water is 68% of total irrigated area. Similarly, for drinking water also from ground water source through bore wells, i.e. 6881 hand pumps, 725 piped water supply schemes and 665 as mini waer supply schemes. Groundwater is to be used more judiciously to support the irrigated agriculture for food production. In irrigated agriculture, following a suitable cropping pattern and increasing the water use efficiency are ever more essential water management strategies to have a sustained groundwater development.

5.1 Ground water development

Dynamic Groundwater Resource Estimation (March 2009) reveals development 72% in the district. As per this estimation, the net ground water availability for future irrigation development is 12740 HAM. As the development in Safe limit and there is scope for development in Chamarajanagar and Yalandur taluks. In Gundlupet and Kollegal taluks, in some areas there is higher development has been noticed and groundwater development should be restricted in these parts and the remaining areas development can be concentrated. Dug wells are the ideal structures in command areas of Yalandur taluk and Kollegal taluk. Dug cum bore wells and bore wells are suitable in the other areas. The diameter may be 5.00m to 8.00m and the depth may be 10.00 to 25.00mbgl. Bore wells may be drilled from the bottom of the dug wells up to the depth of 30.00 to 60.00mbgl to tap weathered zone and shallow fractures wherever it is feasible. Bore wells are possible in all topographic conditions. As revealed by groundwater exploration by CGWB, drilling in a scientifically selected site down to an optimum depth of 150 to 200m can yield a discharge of 2 to 5 lps. In non-command areas and more undulating terrain with a comparatively shallow

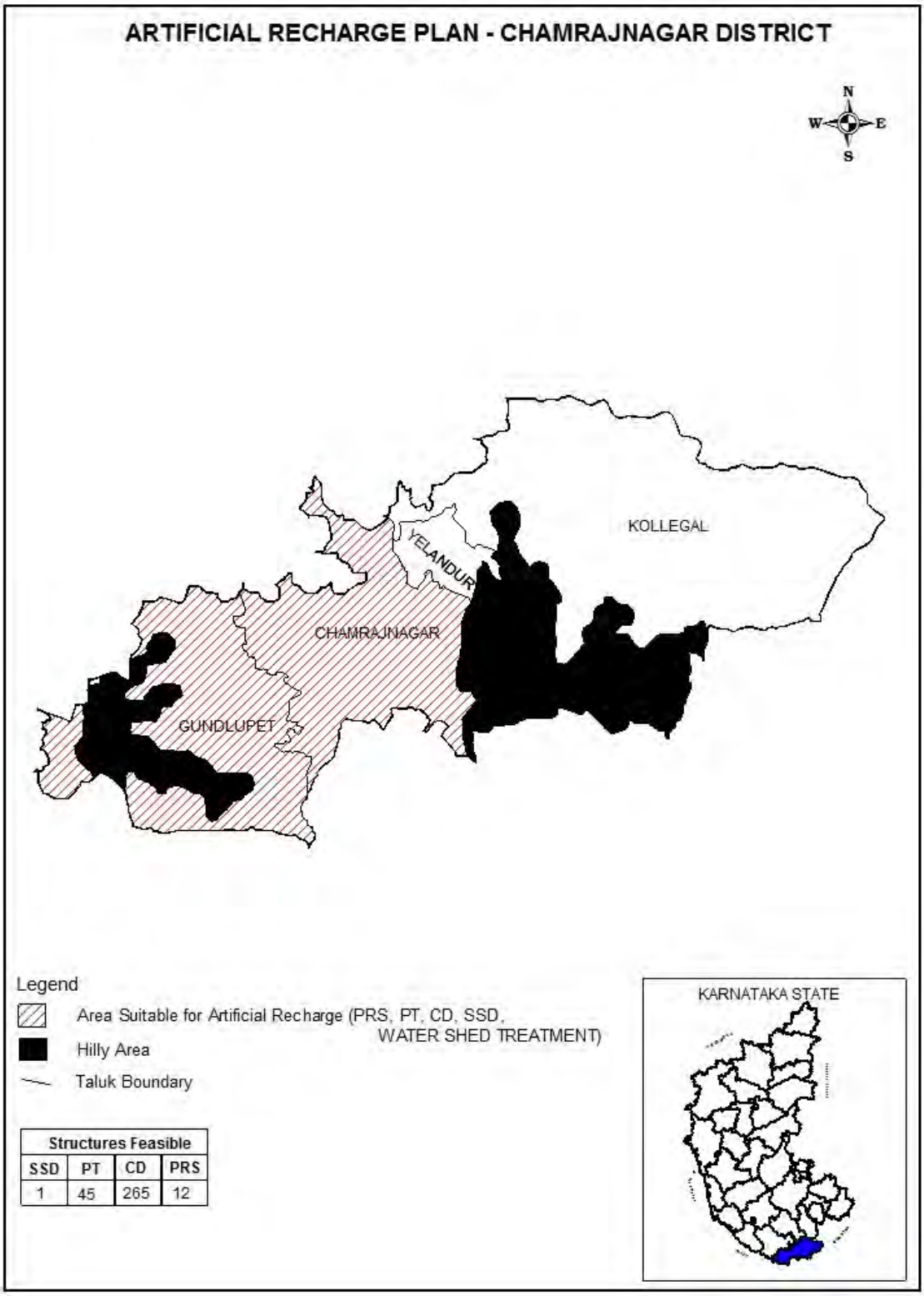
weathered thickness area such development through medium to deep bore wells can be attempted.

While designing the various abstraction structures, a farm budget model can be evolved for the structure with a designed discharge of 2 to 5 lps with an irrigable command of 1.25 to 3.00 ha. The colluviums in Yalandur area requires estimation of the total thickness and its spread over area for further development. Ground water development may also be considered along the banks of rivers and streams in Yalandur taluk in general and command areas of Yalandur and Kollegal taluks. Well density criteria shoud be kept in mind while planning the ground water development.

5.2 Water Conservation and Artificial Recharge

As per the Dynamic Groundwater Resource Estimation (March 2009), the average Stage of Groundwater Development in the district 72%. Groundwater development is not and it varies considerably in different taluks. It varies from 46% in Kollegal taluk to 134% in Gundlupet taluk.In other taluks a moderate development has taken place. Yelandur and Chamarajanagar taluks are in Safe category but, in about 35% of the Kollegal and 25% of the Gundlupet taluk are Over-exploited where furthrr development of groundwater resource is not feasible. These taluks require immediate implementation of measures of conservation and artificial recharge to in order to arrest further decline of water levels. Adoption of such rainwater harvesting practices in such areas in the district is essential to achieve a sustained development of the groundwater resource. Artificial recharge through percolation tank, check dam and nalla bunds, abandoned irrigation dug wells are the solutions to recharge ground water in the district. Kollegal taluk is the largest, where 70% of the total area is predominately hilly and major part of the rainfall leaves the area as surface run off. Under these conditions, it is advisable to go for watershed treatment methods, which can help in augmenting the ground water resources (fig.11). Further, considering the topography, the structures like gully plugs, cement plugs, nalla bunds and contour bunds will be helpful in arresting runoff and recharging the ground water apart from serving the purpose of soil conservation. As per the statistical data, the district has 218 tanks. Maximum of 126 tanks are in Gundlupet taluk, and minimum of 16 tanks are in Kollegal, There is good scope for further construction of percolation tanks,

Fig.11



Structures Feasible			
SSD	PT	CD	PRS
1	45	265	12

check dams and other artificial recharge structures to enhance the recharge in to the ground water system in Kollegal taluk. Most of the existing tanks are silted and dried up. Desilting the tanks and construction of additional tanks will help in recharging the phreatic zone. Sub surface dykes are suitable along the river course where ever thickness of alluvium is adequate.

A Central Govt assisted 'Dug Well Recharge' scheme is under implementation in the district. The scheme is intended to recharge groundwater through abandoned irrigation dug wells with subsidy component to marginal and small farmers borne by the Central Government. The scheme is being implemented by the State Government. As per the latest data (31.3.2012) out of the 477 identified beneficiaries, the scheme is completed by 239 beneficiaries.

6.0 Ground water related issues & problems

Drinking water scarcity exists in the entire district. Thus, groundwater quantity as well as quality problems are of major concern in the district. Groundwater scarcity is on higher scale in Gundlupet and Kollegal taluks where, some parts are under over-exploited category. In Yalandur and Chamarajanagar taluks scarcity of water is observed especially in non-command areas. Excess geogenic (related with the aquifer / rock formation) fluoride is the natural quality problem in the district. High nitrate due to anthropogenic activity like nomal pollution and use of nitrogenous fertilizers is a major quality concern in the canal command areas of Yalandur and Kollegal and Chamarajanagar taluks.

7.0 Awareness & Training Activity

Central Ground Water Board has organised Mass Awareness programme in Kollegal on 06/07/2005 in Shikshakara Bhavana, Kollegal. Smt. Bharati Nagraj, president Zillah Panchayat was the Chief Guest and inaugurated the programme. Shri. S. M. Somashekar, CEO, ZP was the Guest of Honour. As a part of this programme, Drawing competition was organised for school children and certificates were distributed. Working models of artificial recharge and rainwater harvesting were exhibited. Documentaries on ARS and Rainwater Harvesting with case studies and quality of ground water were shown. About 300 representatives from State Government, Educational institutions, Farmer community, Self-help and User group particularly, from Sthree shakti organisation participated in the programme.

Water Management Training Programme (WMTP) was held at Taluk Panchayat Hall, Chamarajanagar on 27th and 28th July 2005. Sri. Bharadwaj, Chairman, Institutions of Engineers, inaugurated the programme. Sri.S. M.Somashekar, CEO, ZP, presided over the function. Lecture on various water related topics were delivered and field visit to rainwater harvesting site was arranged.

8.0 Areas notified by CGWA / SGWA

None of the taluks has been notified under CGWA / SGWA.

9.0 UNIT AREA ANNUAL GROUNDWATER RECHARGE

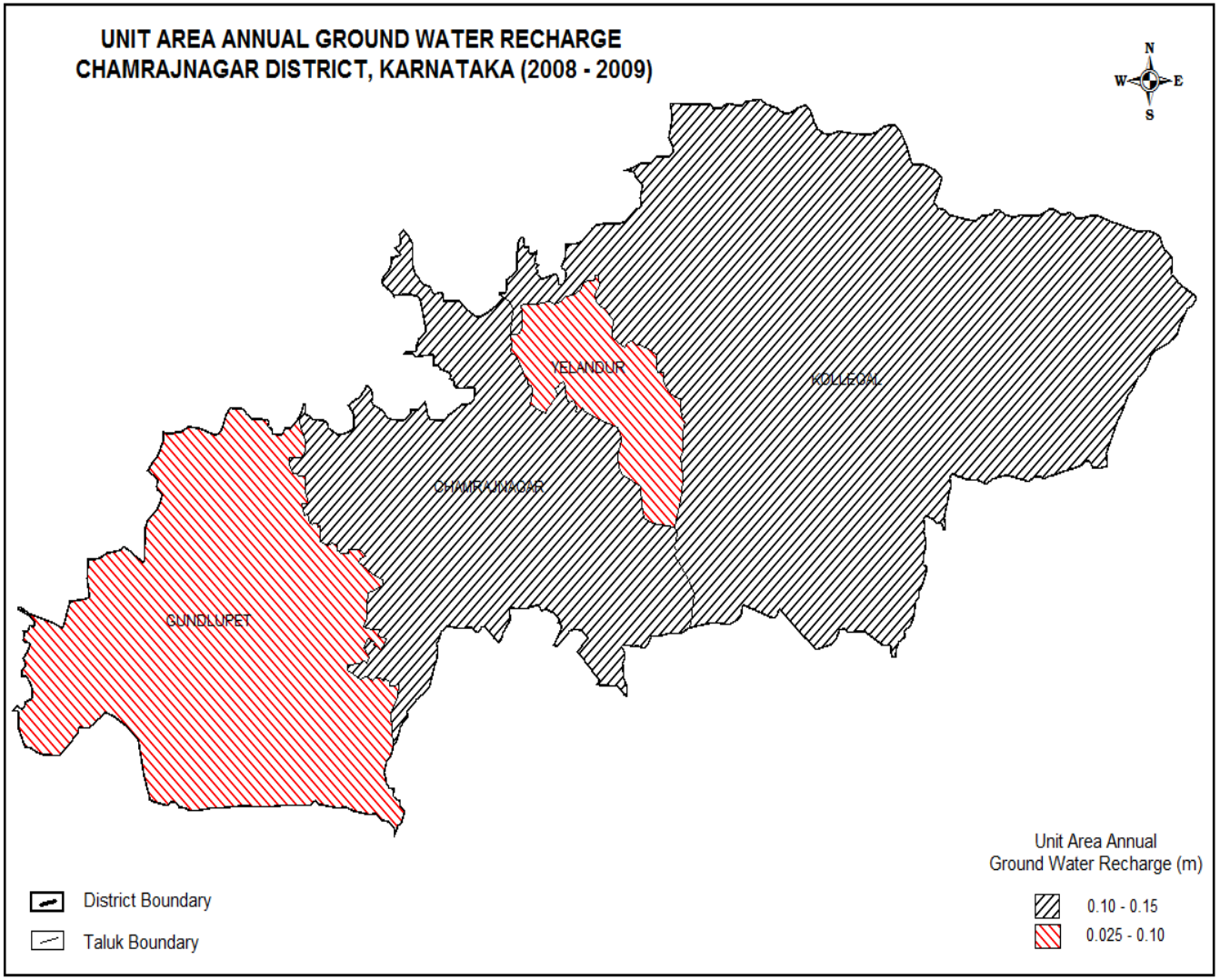
Sustainability of groundwater resource depends mainly on two factors viz. Annual groundwater recharge and annual groundwater draft. The annual groundwater recharge depends on the quantity and intensity of rain fall, the infiltration characteristics of the soil, the depth to groundwater level, the slope of the area and the geomorphology. The groundwater recharge is assessed separately for the monsoon and non - monsoon periods due to rainfall as well as due to other sources. The annual groundwater recharge includes all the above.

The recharge from other sources includes return seepage from irrigated area, seepage from canals, seepage from water bodies, seepage from influent rivers etc. The recharge can be expressed in metres. In Chamarajanagar district, the Unit Area annual recharge ranges from 0.025 to 0.10 m in Yalandur and Gundlupet taluks and from 0.10 To 0.15 m, in Chamarajanagar and Kollegal Taluks (Fig.12).

10.0 Recommendations

A major portion of Chamarajanagar district is hilly and undulating terrain. The steep sloppy topographical condition leads to high runoff. So, adopting water shed treatment is good option in augmenting the natural recharge. Due to the undulating topographical condition, the irrigated agricultural activity is confined to intermountain valleys, resulting in clustering of irrigation wells. This has lead to the over-exploitation of groundwater resources in such areas. The Stage of ground water is the highest (134%) in Gundlupet taluk and over-exploitation of the resource has taken in parts of Kollegal and Gundlupet taluks. Development of groundwater resource has to be restricted in the over-exploited areas. Development is to be undertaken cautiously in Semi-critical parts of Gundlupet and Chamarajanagar taluks. Groundwater management is all the more essential in the over-exploited parts

Fig. 12


UNIT AREA ANNUAL GROUND WATER RECHARGE
CHAMRAJNAGAR DISTRICT, KARNATAKA (2008 - 2009)
N
W
E
S
YELANDUR
KOLLEGAL
CHAMRAJNAGAR
GUNDLUPET
Unit Area Annual
Ground Water Recharge (m)
0.10 - 0.15
0.025 - 0.10
District Boundary
Taluk Boundary

and semi-critical areas of the district. Groundwater augmentation measures through artificial recharge, construction of percolation tanks, watershed treatments should be implemented in resource depleted areas. In addition to this, the abandoned bore well/dug wells can be utilised for recharging aquifers with surplus runoff during rainy days as implemented in Gundlupet and Kollegal taluks under Central Govt assisted Dug Well Recharge Scheme during 2007 –2011. The scheme should be extended to all semi- critical, critical and over-exploited areas in the district. Following the proper cropping pattern, crop-water manegement and adopting water economy irrigation practices should be the part of groundwater management. Construction of pizometers to monitor water levels on long term basis can help to keep a watch on water levels and help to initiate remedial measures. The villages located in hilly regions of the district facing drinking water scarcity. In command areas, rise in groundwater level should be checked to avoid water logging and salinity problems.