

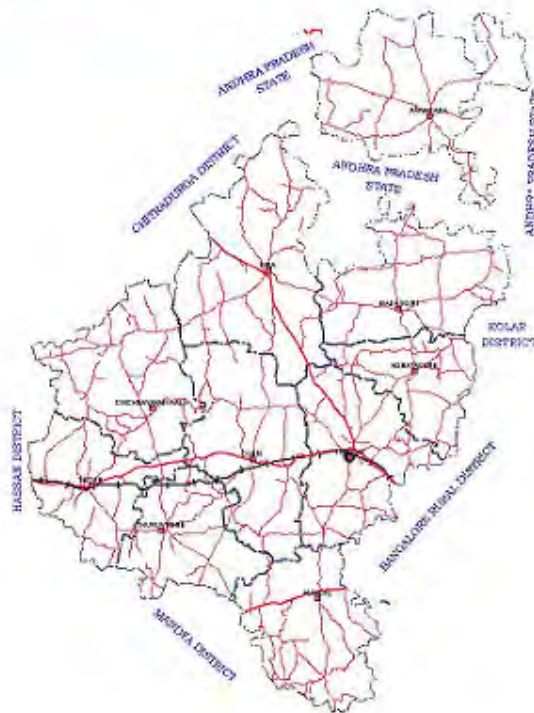


समय सुरक्षित जल - सुरक्षित स्वास्थ्य जल  
CONSERVE WATER - SAVE LIFE



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

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



**SOUTH WESTERN REGION  
BANGALORE  
September 2012**

डॉ. एस. सी. धीमान  
अध्यक्ष  
भारत सरकार  
केन्द्रीय भूमि जल बोर्ड  
जल ससाधन मंत्रालय  
भुजल भवन  
एन.एच. 4 फरीदाबाद  
मो न. : 9868218549  
फोन. न. : 0129-2419075  
फैक्स : 0129-2412524



**Dr. S.C. Dhiman**  
Chairman  
Government of India,  
Central Ground Water Board,  
Ministry of Water Resources,  
Bhujal Bhawan,  
NH-IV, Faridabad - 121 001  
Mobile : 9868218549  
Ph. (O) : 0129-2419075  
Fax : 0129-2412524  
E-mail : tschmn-cgwb@nic.in

## 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, vulnerability area 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, incorporating the data up to the period 2011-12.

The Tumkur 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. G.R.C.Reddy, Scientist-D. The figures were prepared by Sri. J. Sivaramakrishnan, Assistant Hydrogeologist and 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, academicians, hydrogeologists and engineers to plan the water resources management in a better way in the district.

**(Dr. K.Md.Najeeb)**

**Regional Director**

**TUMKUR DISTRICT AT A GLANCE**

1	GENERAL INFORMATION	Statistics																
	i) Geographical Area	10597Sq. Km																
	ii) Administrative Divisions (March2011)																	
	No. of Taluks/Hoblies	10/50																
	No of Panchayats/villages	321/2708																
	iii) Population (as on 2011 census)	26.81 lakhs																
	iv) Average annual Rainfall	780 mm																
2	GEOMORPHOLOGY																	
	Major physiographic units	1. Denudational uplands 2. Structural ridges																
	Major Drainages	Krishna, Pennar and Cauvery basins																
3	LAND USE(2009-10)																	
	a) Forest Area (Hectares)	45177 (4.24%)																
	b) Net Area Sown (Hectares)	563421 (52.91%)																
	c) Cultivable Area (Hectares)	624381																
4	MAJOR SOIL TYPES	1. Red Loamy 2. Red Sandy 3. Mixed Red and Black soil																
5	AREA UNDER PRINCIPAL CROPS ( 2009-10)	<table border="0"> <tr> <td>Crops</td> <td align="right">Hectares</td> </tr> <tr> <td>Ragi</td> <td align="right">162613</td> </tr> <tr> <td>Groundnut</td> <td align="right">99357</td> </tr> <tr> <td>Paddy</td> <td align="right">36033</td> </tr> <tr> <td>Maize</td> <td align="right">19886</td> </tr> <tr> <td>Sunflower</td> <td align="right">8092</td> </tr> <tr> <td>Sugarcane</td> <td align="right">2935</td> </tr> <tr> <td>Cotton</td> <td align="right">852</td> </tr> </table>	Crops	Hectares	Ragi	162613	Groundnut	99357	Paddy	36033	Maize	19886	Sunflower	8092	Sugarcane	2935	Cotton	852
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Sunflower	8092																	
Sugarcane	2935																	
Cotton	852																	
6	IRRIGATION BY DIFFERENT SOURCES(2009- 10)	Hectares																
	Tanks	19019																
	Canals	3014																
	Dug wells	1484																
	Bore wells	145056																
	Other Sources	Nil																
	Net Area Irrigated	168573																
	Gross Irrigated Area	193547																
7	NUMBER OF GROUND WATER MONITORING WELLS OF CGWB																	
	Dug wells	31																
	Piezometers	20																
10	PREDOMINANT GEOLOGICAL FORMATIONS	Archaean Complex (Granite, Gneisses and Schists)																

11	HYDROGEOLOGY	
	Major water bearing formations	Weathered and fractured Granite Gneisses and schists, Pegmatite
	Premonsoon Depth to water level (2011)	1.17-31.70 mbgl
	Postmonsoon Depth to water level (2011)	0.26-25.84 mbgl
	Long term water level trend (2002-2011) in m per year	Mostly rising trend
12	GROUND WATER EXPLORATION BY CGWB AS ON MARCH 2011	
	EW	96.68-204.19    0.31-11.0 lps
	OW	69.46-151.71    0.8 - 8.72 lps
13	GROUND WATER QUALITY	
	Presence of chemical constituents more than permissible limits	Fluoride, Nitrate and Chloride
	Type of water	Potable in general
14	DYNAMIC GROUND WATER RESOURCES (2009) IN Ha.m	
	Annual replenishable ground water resource	84061
	Net annual ground draft	73179
	Projected demand for Domestic and Industrial use up to 2025	6969
	Stage of ground water Development (%)	93.68 %
15	MASS AWARENWSS PROGRAMME ORGANISED	
	Date	27.03.99
	Place	Sira
	No of participants	500
	WATER MANAGEMENT TRAINING PROGRAMMES ORGANISED	
	NIL	
16	EFFORTS OF ARTIFICIAL RECHARGE AND RAINWATER HEAVESTING	
	NO	
17	GROUND WATER CONTROL AND REGULATION	
	NOT NOTIFIED	
18	MAJOR GROUND WATER PROBLEMS AND ISSUES	
	QUALITY PROBLEM	High concentration of fluoride
	DRYING OF WELLS	Most of the dug wells dried up because of lowering of water levels due to over exploitation of ground water

## **1.0 Introduction**

Tumkur district is located in the south eastern part of Karnataka state. It lies between north latitudes 12<sup>0</sup>45' and 14<sup>0</sup>22' and east longitudes 76<sup>0</sup>24' and 77<sup>0</sup>30' falling in the Survey of India degree sheet Nos – 57 B, 57 C, 57 D, 57 F, 57 G and 57 H. The district is having a total geographical area of 10597 sq. km. The shape of the district is irregular with the NE part of it is totally detached from the remaining area.

### **1.1 Administrative Setup and Accessibility**

The district headquarters is Tumkur town which is just 70 Kms from Bangalore on Pune –Bangalore National highway No 4. The main Bangalore –Miraj railway line passes through Tumkur, Gubbi and Tiptur towns. There are 10 taluks, 50 hoblies, 321 gram panchats, 10 towns, 4 municipalities, 3 pattana panchayats and 2708 villages. out of 2708 villages, 2574 are inhabited and 134 are uninhabited. Map showing location, administrative divisions, roads etc is given in fig 1.

### **1.2 Population**

As per 2011 census, the total population in the district is 26,81,449 persons which is 4.39% of the population of Karnataka, with a density of 253 persons/sq.km .The percentage decadal growth rate is 3.74%(2001-2011).The rural and urban population constitutes 77.52% and 22.48% respectively. The sex ratio is 979 and the literates constitute 74.32% of total population. The child (up to 6 yrs old) population constitute 9.41% of the total population.

### **1.3 Drainage**

The district is drained by both north flowing Pennar, and Lower Tungabhadra and south flowing Lower Cauvery basins. None of these rivers is perennial in nature. The major surface water divide between north and south flowing rivers passes through north of Tiptur, Gubbi and Tumkur towns. Pennar Basin is primarily comprised of three watersheds viz 4C3H2, H3 and H4 and is drained by Jayamangala and Kumudvathi rivers. Lower Tungabhadra Basin is drained by Vedavathi and Suvarnamukhi rivers and primarily comprised of four watersheds viz 4D3D3, D6, D7 and D8 .

River Shimsha drains the area falling in Lower Cauvery Basin and is primarily comprised of five watersheds viz 4B3D1, D2, D3, D4 and 4B3C5. The rivers and streams originate from small watersheds and empty into a number of tanks scattered in the district. The drainage pattern in the area can be described as semi dendritic to dendritic. Drainage map of the district is given in fig 2.

### **1.4 Land use**

During the year 2009-10 about 45177 ha of land, which is only 4.24% of the total area had been covered by forests. The land not available for cultivation is about 151981 ha (14.27%) and other uncultivated land is about 151981 (15.03%). Fallow land covers 144048 ha which is 13.52% of the total area. The net area sown is 563421 ha ( 52.91%) and the area sown more than once is 60960 ha.

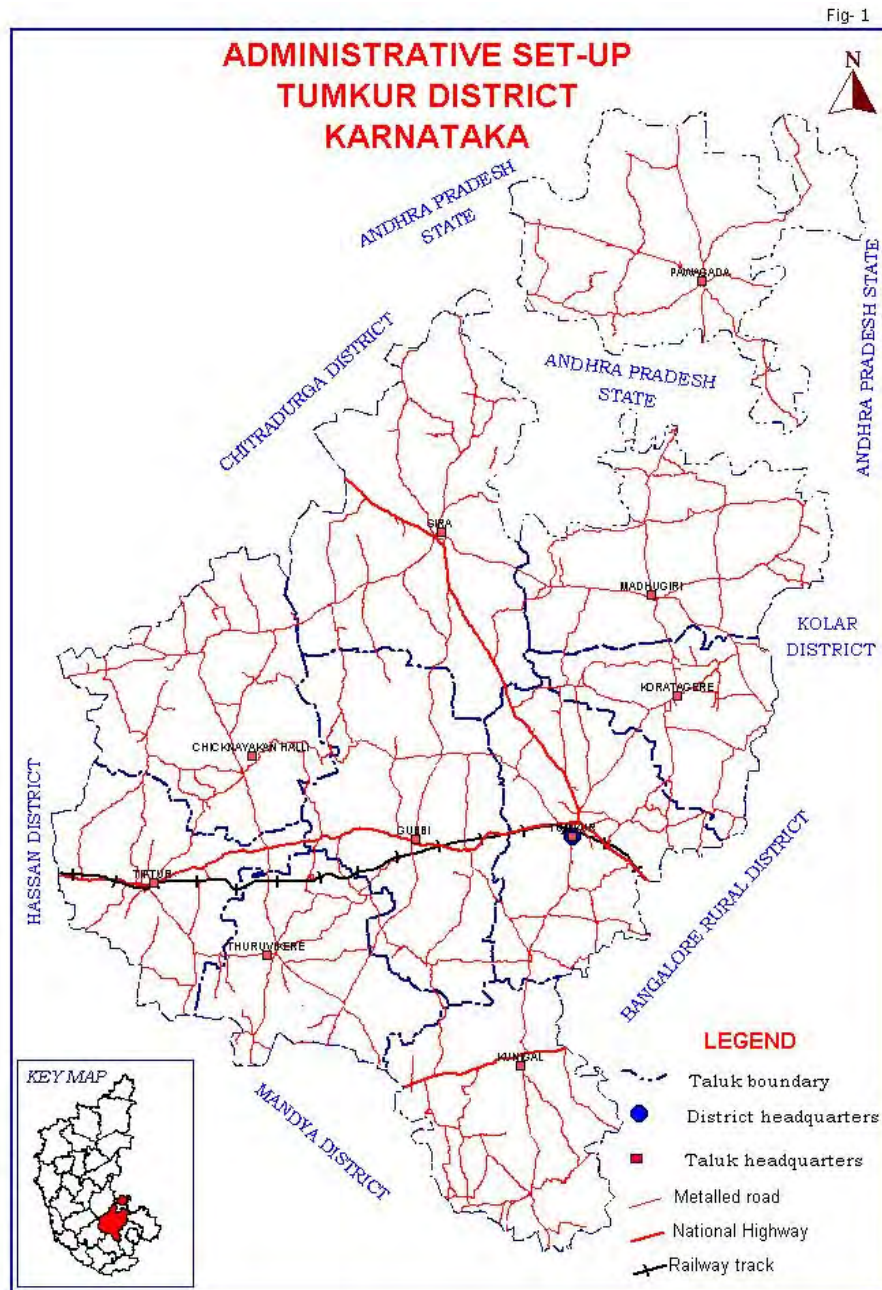
### **1.5 Cropping pattern**

The major crops grown in the district as per 2009-10 agriculture statistics are Ragi(162613 ha), groundnut(99357 ha) paddy(36033 ha), horse gram(22973 ha)

maize(19866 ha) sunflower (8092 ha), sugarcane 2935 ha and perennial plantation crops such as coconut and arecanut.

### 1.6 Irrigation

There are no functional major irrigation projects in the district. However part of the command area of the Hemavathy project (The reservoir built across Hemavathy

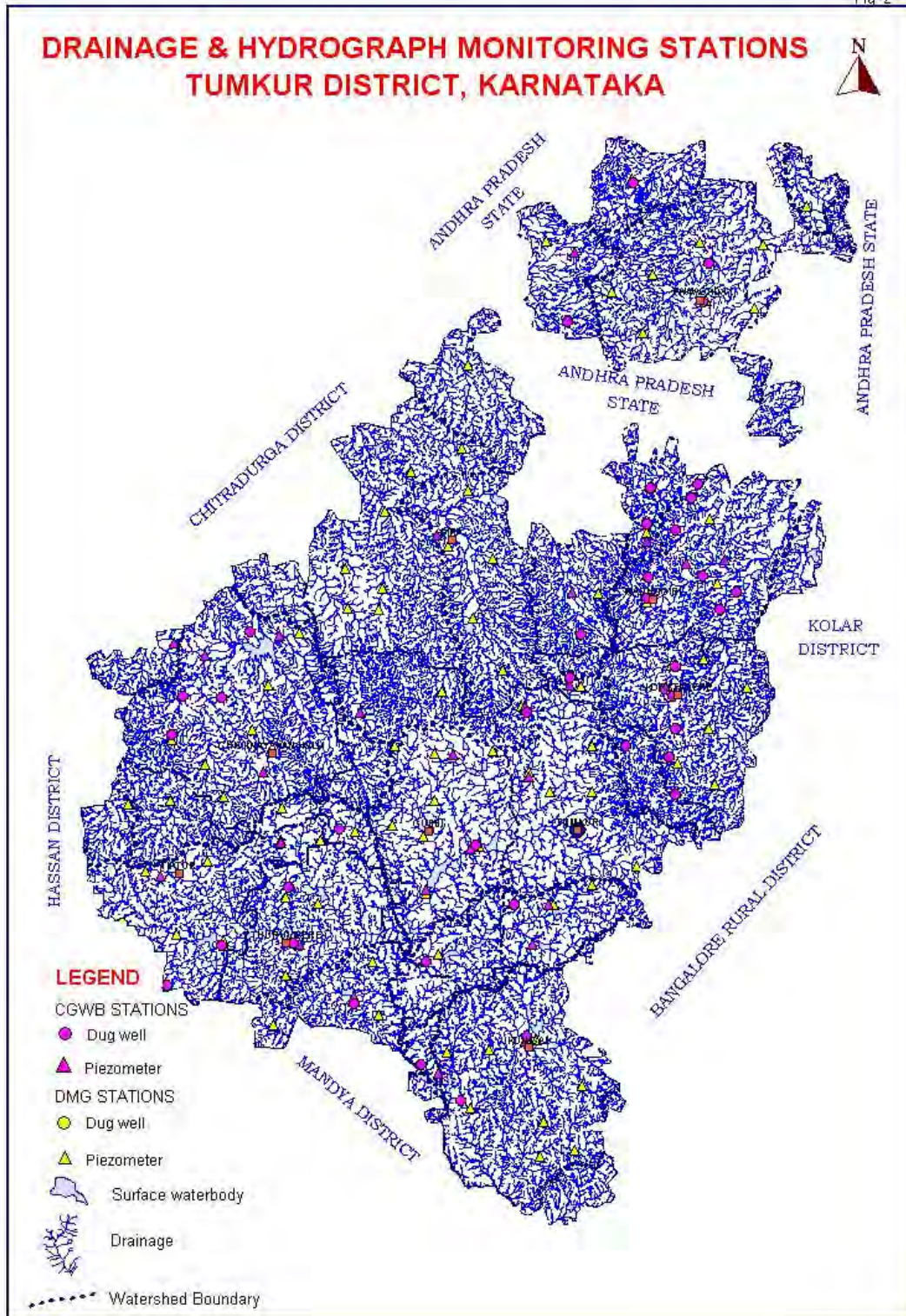


river, located near Gorur village in Hassan District) falls in Tumkur district. There are two medium irrigation projects namely Marconahalli reservoir (Kunigal taluk) and Sri Gayatri reservoir (Hiriyur taluk, Chitradurga District) irrigating parts of C.N.Halli taluk,



irrigating 4610 and 1210 ha. of land respectively. There are 1642 minor irrigation tanks in the district irrigating 22,439 ha. of land and having a cumulative storage capacity of 778.52 MCM. The Hemavathy project which on completion is expected to irrigate 2,37,000 acres of land in Tumkur district.

Fig-2





Out of 563421 ha of net area sown during the year 2009-10, 168573 ha (29.91%) were under irrigation. The source wise net and gross area irrigated is given in table 1.

**Table-1.Source wise net and gross area irrigated during 2009-10 (ha)**

Sl no	Source	Nos/length(km)	Net area irrigated	Gross area irrigated
1	Canals	86.7	3014	4199
2	Tanks	1642	19019	22439
3	Dug wells	39556	1484	1547
4	Bore wells	118107	145056	165362
5	Lift irrigation	0	0	0
6	Others	0	0	0
<b>District Total</b>			<b>168573</b>	<b>193547</b>

It is observed from the table that the surface water sources (canals and tanks) irrigate only 26638 ha (14%) where as ground water sources (dug wells and bore wells) irrigate 166909 ha (86% of the total area irrigated). It can be observed that 39556 dug wells irrigate only 1547 ha (1%) where as 118107 bore wells irrigate 165362 ha (99%) showing the predominant role of bore wells in irrigation . Each bore well on average grossly irrigate 1.4 ha where as the each dug well on average grossly irrigate meager 0.039 ha only.

### **1.7 Studies Carried out /ongoing by CGWB**

1. A pilot project on aquifer mapping in Ankasandra watershed in parts of Tiptur and Chiknayakanhalli taluks is under progress to delineate aquifer geometry, aquifer potential and to develop an Aquifer information management System (AIMS),through which aquifer management plans will be formulated.
2. Balachandra L.J.,covered three taluks of the district viz; Tiptur, Gubbi, and Tumkur under Reappraisal Hydrogeological surveys during the AAP 2003-2004.
3. Kumaresan K. covered the parts of Madhugiri and Pavagada taluks under ground water management studies during the AAP 2002-03.
4. Afaque Manzar, carried out reappraisal hydrogeological surveys in C.N. Halli, Sira and Koratagere taluks during the AAP 1997-98.
5. A.Suresha, carried out reappraisal hydrogeological surveys in Turuvekere taluk during the FSP 1994-95.
6. Afaque Manzar, carried out micro level hydrogeological surveys in Tiptur, Gubbi and Turuvekere taluks during the FSP 1993-94.
7. S.J.Prasad and V.S. Prakash prepared the ground water resources and development potential report of Tumkur district, Karnataka during the year 1993-94.
8. K.R.Sooryanarayana, carried out systematic Hydrogeological surveys in parts of Koratgere and Madhugiri taluks of Tumkur district during the FSP 1992-93.

9. D.N.Ramarao, carried out systematic hydrogeological surveys in parts of Gubbi, Kunigal and Tumkur taluks during the FSP 1981-82.
10. Project study titled "Estimation of Ground water Resources in Vedavathi River Basin" carried out during 1975-1979 under Vedavathi River Basin Project.

## **2.0 Climate**

The climate of the district is free from extremes, except Pavagada taluk where it is relatively hot. The year may broadly be classified into four seasons. The dry season is from January to February, followed by hot weather from March to May. The SW monsoon season is from June to September and the NE monsoon period from October to December.

### **2.1 Rainfall**

The amount of rainfall is being measured from 10 stations located at each taluk headquarters. A study of the rainfall data for the period from 2001 to 2010 from all the stations has shown that the amount of rainfall varies considerably in space and time. The normal rainfall in the district is 780mm and it varies from 918 mm at Tumkur to 620mm at Pavagada. The isohyets drawn from normal rainfall indicates that the amount of rainfall is maximum in eastern part around Tumkur and it sharply reduces to 620 mm at Pavagada towards north. It slowly reduces towards west towards Tiptur to 769 mm.

December to March is the very low rainfall months. September is the wettest month with monthly rainfall in excess of 170mm. The rainfall occurs in nearly 45 days in a year. The pre monsoon period contributes an average rainfall of 166 mm (21%), the SW monsoon period contributes 417 mm (54%) and the NE monsoon period contributes 197mm(25%).

During the year 2011, the district received an average rainfall of 673mm. However it varied spatially from 333 mm at Pavagada to 814 mm at Koratagere.

### **2.2 Temperature**

The temperatures start rising from January to a peak of around 34° C in April, the hottest month in the district. Thereafter it declines during the monsoon period and December is coldest month and the temperatures dips down to 16°C.

### **2.3 Humidity**

The humidity is lowest during the dry season and highest during the monsoon period.

### **2.4 Wind speed**

The winds are predominantly south westerly during the summer monsoon and northeasterly during the winter monsoon.

### **2.5 Evapotranspiration**

The annual potential Evapotranspiration is over 1800mm with monthly rates less than 100mm during December and January and over 250 mm during May.

## **3.0 Geomorphology and Soils**

Geomorphologically, a major part of the district is covered with the denudational uplands on gneisses and granites which are ideal for agriculture, industrialization and urban settlements, given suitable inputs. Besides there are structural ridges of

the schistose rocks are suitable for mining of manganese, dolomite and limestone deposits. The denudational hills of granite in the NE part can be quarried for building stones and road metal. The valley flats in the southern part of the district can be exploited for agricultural purposes.

To the east of Tumkur and north of Devarayana Durga, the region presents beautiful scenery of hill ranges intersected by cultivated valleys. A narrow range of granitic hills grouped under Closepet granites occupies the eastern part. These hills pass through the taluks of Pavagada, Madhugiri, Koratagere and northern parts of Tumkur. In the eastern part, the hills comprising of schistose rocks pass through Chikkanayakanahalli, Sira, and Gubbi taluks. The prominent hills in the eastern range of hills are Madhugiridurga (1199 m), Devarayanadurga (1187m), Nidugal (1148m), Channarayadurga (1138 m), Hutridurga (1130), Nijogal (1086m), Kamandadurga (1077 m), Koratagiri (879m), and Huliyardurga (844m) above mean sea level. The landmass in the plains ranges between 450 to 840 m above msl, while hilly areas range between 840 to 1200 m above msl.

A major part of the district is occupied by red sandy soil, red loamy soil along the eastern part. Very small part in NW part of CN Halli taluk is occupied by mixed red and black soils. Red sandy soils are suitable for the growth of ragi, jowar, millets and oil seeds under rain fed conditions. The irrigated areas of red loamy soils are favourable for paddy, sugarcane and vegetables.

#### **4.0 Ground water Scenario**

##### **4.1 Geology**

The district exposes mainly rock types belonging to the Peninsular Gneissic complex (PGC), schistose rocks of Sargur group and Dharwar super group, younger intrusives (Closepet Granite and basic dykes) and thin patches of quaternary gravels. The PGC occupy two-thirds of the area and is represented by migmatite, gneiss and other granitoids. The high grade schists of Sargur group occur as continuous bands, small enclaves within the PGC and comprise amphibolites, ultramafics and banded ferruginous chert. The rocks of Dharwar super group are exposed in two parallel belts belonging to southern continuation of Chitradurga and Javanahalli schist belts. The younger intrusives include Closepet granite and basic dykes. Thin patches of Quaternary gravel horizons are located north of Pavagada. There are three prominent lineaments in ENE-WSW, NW-SE and N-S directions in the district.

The alluvial patches are generally seen along the major streams as narrow discontinuous patches particularly in granite country. The maximum thickness of the alluvium in the Suvarnamukhi basin is 14 m. The alluvium in Jayamangali and Kumudavathy rivers is sandy in nature and attains a thickness of only 10 to 13 m.

## 4.2 Occurrence and movement of Ground water

Ground water occurs in weathered and jointed zones of gneisses, granites and schists and alluvium in unconfined or water table conditions where as it occurs in semi confined to confined conditions in fractured formations at deeper depths.

Unconfined aquifer system is developed by dug wells, shallow bore wells and filter points. This zone extends down to 10-30 mbgl depth. The yield range of irrigation dug wells in alluvium is 50-150 m<sup>3</sup>/day where as the same in weathered formation is 10 to 50 m<sup>3</sup>/day. The yield of filter points is in the range of 50-200 m<sup>3</sup>/day. As the filter points are located in alluvium of limited thickness, many of them become dry during summer. Due to over exploitation in many pockets, this zone is getting dried up gradually.

Semi confined to confined aquifer is formed due to fractures in hard formations at deeper depths. This aquifer system is developed by bore wells ranging in depth up to 200m. The general yield ranges from negligible to 120 m<sup>3</sup>/day, and specific capacity ranges from 2 to 173 lpm/mdd. The ground water condition wise ,structure wise yield ranges in Tumkur district is given in Table 2.

**Table-2. Structure wise, condition wise yield ranges in Tumkur district**

Ground water condition	Structure	Depth Range (mbgl)	Yield range (m <sup>3</sup> /day)	Aquifer material	Specific capacity (lpm/mdd)
Unconfined	Filter point	~~20	100-200	Alluvium	-----
	Dug well	5-16	50-150	Alluvium	-
	Dug well & Shallow bore wells	Up to 50	10-50	Weathered and jointed formation	1-158
Semi-confined to Confined	Bore well	Up to 200	Negligible-120	Fractured hard rock	2-173

## 4.3 Depth to ground water level

The Board is monitoring water levels four times in a year during January, May, August and November every year from the permanent observation wells to observe the behavior of ground water in time and space.

### 4.3.1 Pre monsoon depth to ground water level (May 2011)

The depth to ground water level data collected from 31 permanent observation network from dug wells used for analysis of water levels .It is observed that the depth to ground water level during May 2011 varies from 1.17 to 11.85 mbgl. In general major part of the district having depth to water levels 2 to 5m and 5 to 10 mbgl. Very small isolated pockets in Pavagada ,Turuvekere and Koratagere taluks fall in 0-2 m category. More than 10 m bgl observed at Hebbur in Kunigal taluk.

The depth to water levels in 20 Piezometers during May 2011 varies from 4.12m to 31.70m. The deepest water levels are noticed at Dandinadibba (31.70m) and 26.44 m at Kibbanahalli locations. The shallowest water levels are noticed at Koratagere

(4.12m) and Hosakere (4.45m) locations. A depth to water level map prepared based on the water levels in dug wells is shown in fig 3.

Fig. 3

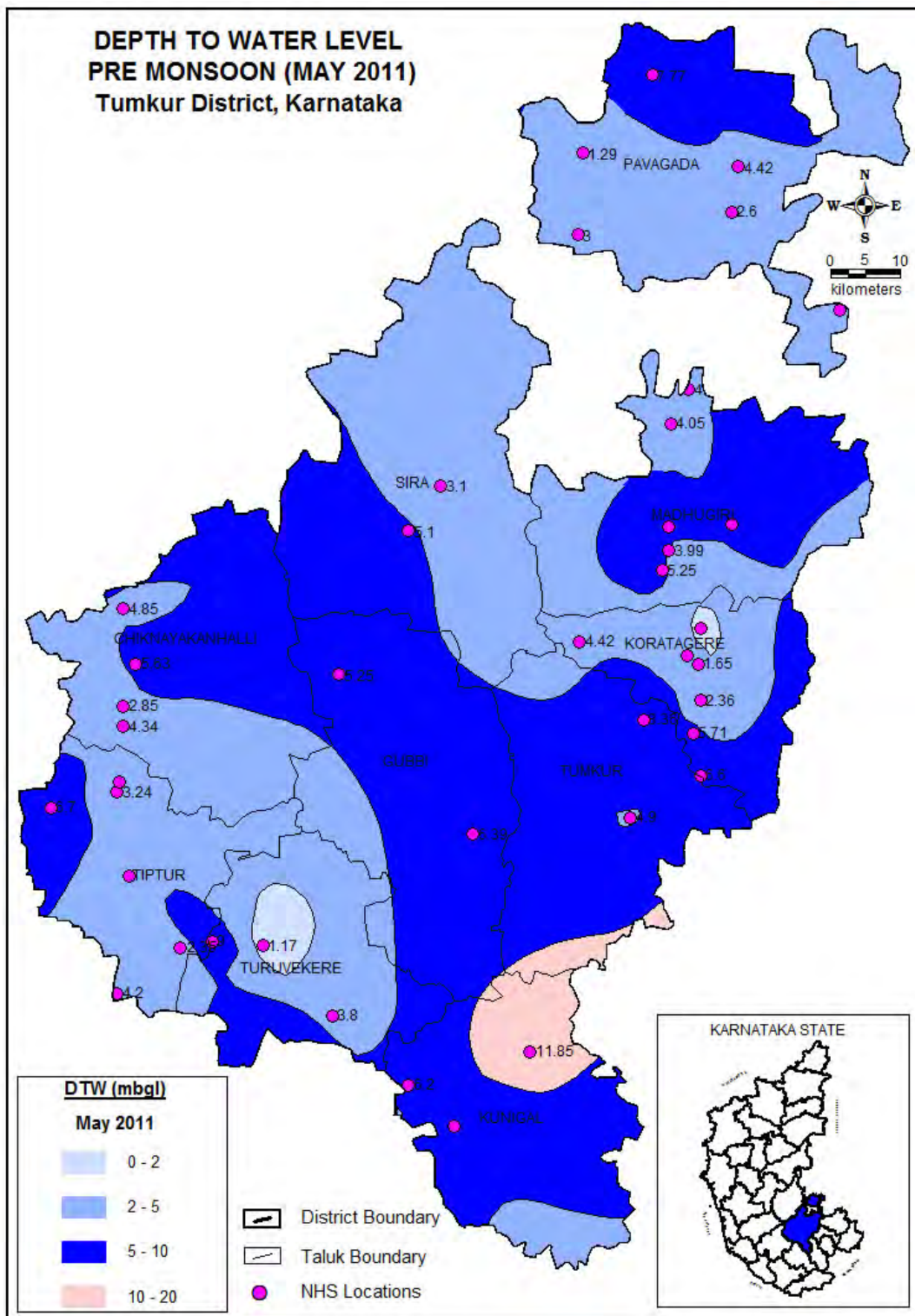
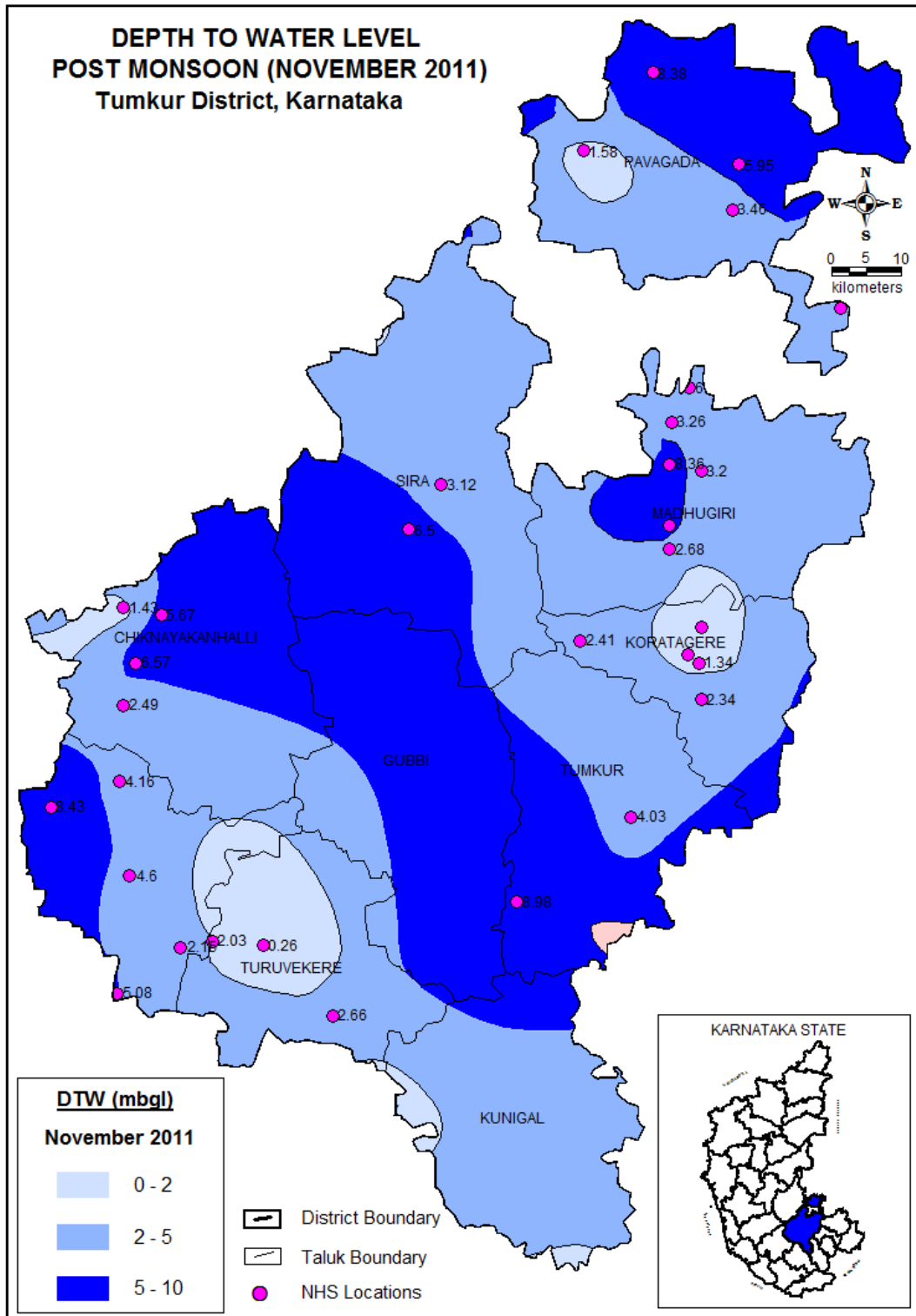




Fig. 4



### **4.3.2 Post monsoon Depth to ground water level (November 2011)**

Post monsoon depth to water level in dug wells (NHS) varies from 0.26 to 10.65 m bgl. The shallowest water level noticed at Turuvekere and the deepest water level noticed at Hebbur. In general major part of the district having depth to water levels ranges from 2 to 5 and 5 to 10 mbgl. Very small isolated pockets in Pavagada, Turuvekere and Koratagere taluks fall in 0-2 mbgl category. More than 10 m bgl observed at Hebbur in Kunigal taluk.

The depth to water levels in 20 Piezometers during November 2011 varies from 1.35m to 25.84m. The deepest water levels are noticed at Kibbanahalli station. The shallowest water levels are noticed at Sira (1.35m) and Koratagere (2.72m) locations. A depth to water level map prepared based on the water levels in dug wells is shown in fig 4.

## **4.4 Ground Water level Fluctuation**

### **4.4.1 Seasonal Fluctuation (May 2011 vs November 2011)**

It is observed from the depth to water level data, there is both rise and fall of water levels in November 2011 when compared to May 2011 water levels. 55% of observation wells have shown seasonal rise of water level in the range of 0.02 to 6.97m where as 45% have shown fall of water level in the range of 0.02 to 1.73 m during 2011. The highest rise (6.97m) is noticed at Somnehalli station in Tiptur taluk.

### **4.4.2 Decadal mean (May 2001-May 2010) with May 2011**

The decadal mean pre monsoon water level data (May 2001 to May 2010) compared with May 2011 water level data. It is observed that there is rise of water level of 0-2 m in most of the area. Rise of water level 2-4 m was observed in SW part and also in small patches in northern side of the district. More than 4m rise observed in two small isolated patches in Turuvekere and Pavagada taluks. The fall of 0-2 m is observed in very small patches on eastern and western boundaries. The water level fluctuation is shown in fig 5

### **4.4.3 Decadal mean (November 2001-November 2010) with November 2011**

The decadal mean post monsoon water level data (November 2001 to November 2010) compared with November 2011 water level data. It is observed that there is rise of water level of 0-2 m in most of the area. Rise of water level 2-4 m was observed in small isolated patches. More than 4m rise observed in one very small isolated patch in Chiknayakanhalli taluk. The fall of 0-2 m is observed in parts of Pavagada, Madhugiri, Kunigal, Tumkur, Gubbi and Tiptur taluks. The water level fluctuation is shown in fig 6

## **4.5 Long term water level trend**

To study the behavioral changes of ground water on a long term basis, the depth to water level data of observation wells (both dug wells and Piezometers) from January 2002 to December 2011 were analysed.

Fig. 5

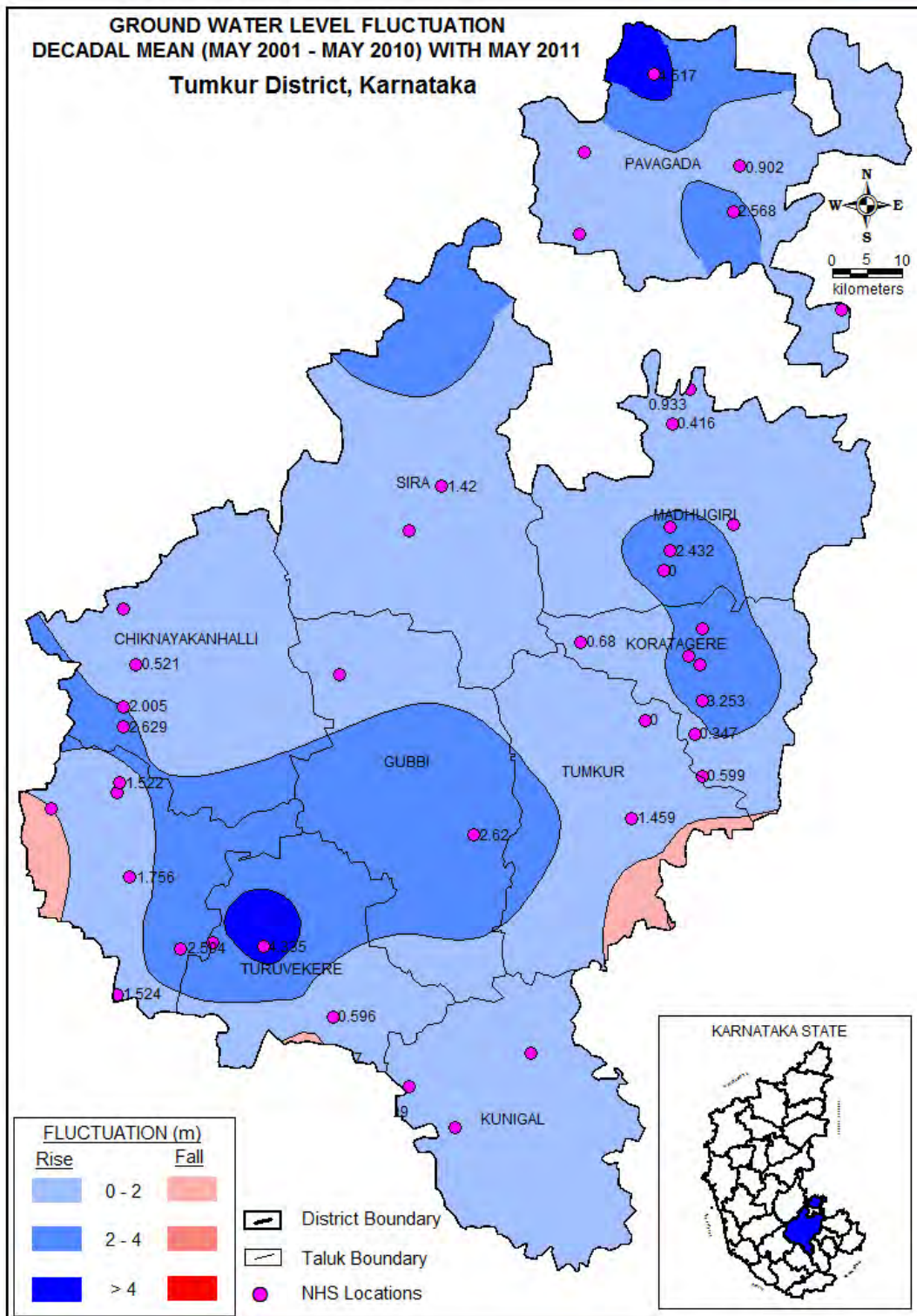
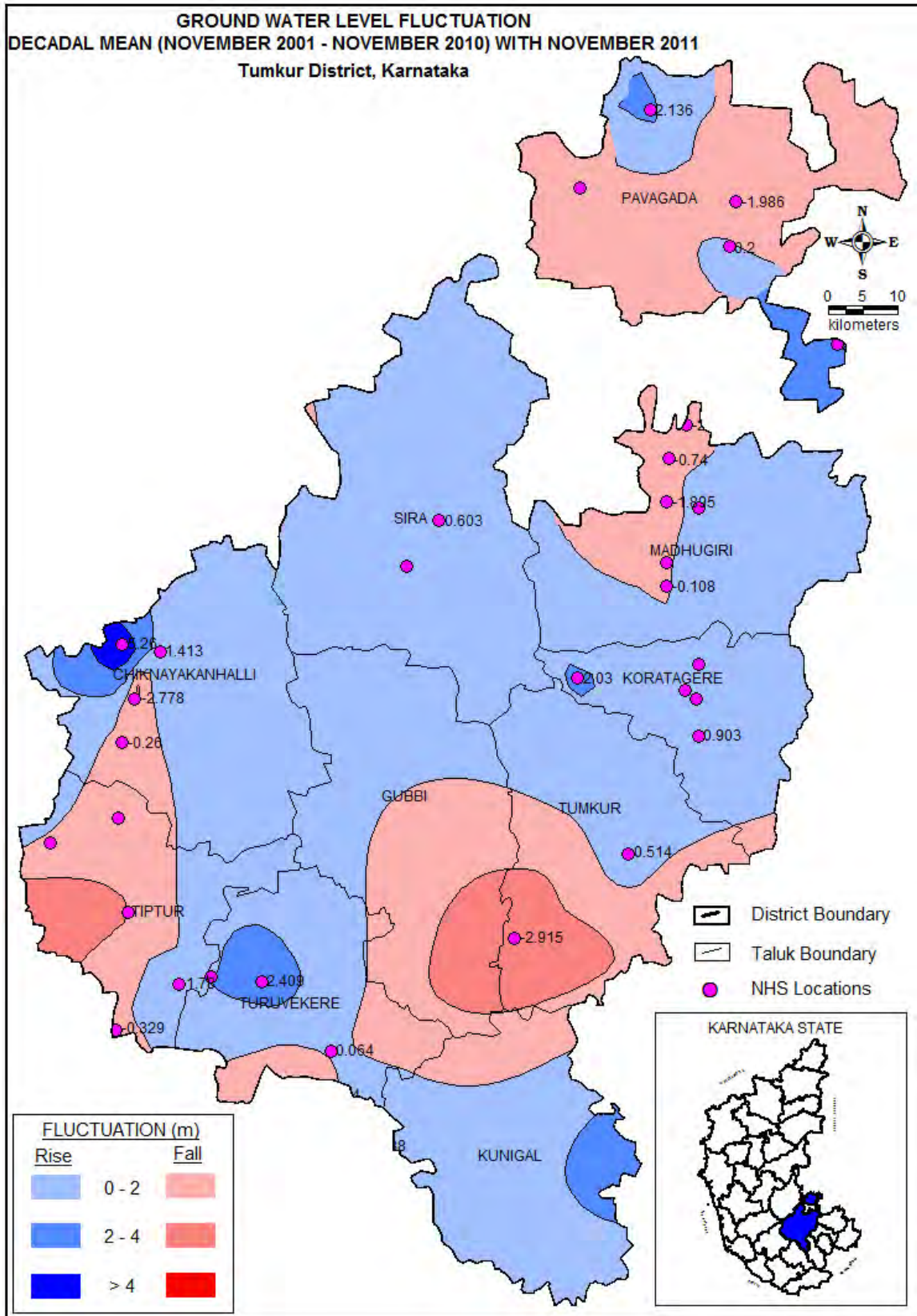


Fig. 6



#### **4.5.1 Pre monsoon long term water level trend (May 2002 to May2011)**

Out of 27 dug wells, 25 wells shown rise and the remaining 2 wells shown falling trend. Out of 25 Piezometers, 19 Piezometers shown rise and the remaining 6 Piezometers shown falling trend.

#### **4.5.2 Post monsoon long term water level trend (November 2002 to November2011)**

Out of 34 dug wells, 30 wells shown rise and the remaining 4 wells shown falling trend. Out of 24 Piezometers, 20 Piezometers shown rise and the remaining 4 Piezometers shown falling trend.

#### **4.5.3 Long term water level trend during the decade (January 2002 to December 2011)**

Out of 42 dug well stations 38 stations show rise and the remaining 4 stations show fall of water level .The highest rise of water level 1.707m/year was noticed at Somnehalli in Tiptur taluk followed by 1.408 m/year at Yadiyur in Kunigal taluk. The fall of water level noticed at Hosakere, Pulamachi, Honnavalli and Tiptur stations.

Out of 27 Piezometer stations ,20 stations show rise and the remaining 7 stations show fall of water level .The highest rise of water level 3.178 m/year was noticed at Gubbi followed by 2.587 m/year at Hagalwadi in Gubbi taluk . The fall of water level noticed at Yelanadu, Bellavi, Nagavalli ,Hebbur ,Yediyur, Boranakanive and Tumkur stations.

#### **4.6 Specific yield of unconfined aquifer**

The studies carried out in the phreatic aquifers through dug wells reveal that the Specific capacities are in the range of 1.02 to 158 lpm /mdd. The specific yield of aquifers varies from 1.5 to 3.0. The sustained yield of wells varies from 11 to 126 m<sup>3</sup>/day in Gubbi taluk, 17 to 143 m<sup>3</sup>/day in Kunigal, 90 to 250 m<sup>3</sup>/day in Koratagere taluk, 20 to 47 m<sup>3</sup>/day in Sira taluk, 28 to 64 m<sup>3</sup>/day in Tiptur taluk, 24 to 56 m<sup>3</sup>/day in Tumkur taluk and 46 to 73 m<sup>3</sup>/day in Turuvekere taluk.

#### **4.7 Aquifer parameters of confined aquifers**

The exploratory bore wells drilled in three phases in the depth range of 34 to 204.19 m and the results of aquifer tests revealed that the gneissic and granitic complex have an effective porosity of about 1 to 3%. The yield cum recuperation tests conducted on the wells show that the general specific capacity ranges from 2 to 39 lpm/mdd and at places in the higher order of 155 to 173 lpm/mdd. The Transmissivity of aquifer material in general range from 18 to 52 m<sup>2</sup>/day, at places it is recorded as high as 176 to 248 m<sup>2</sup>/day. The map showing the exploratory bore wells is shown in fig 7. The Hydrogeology of the district is shown in fig 8

#### **4.8 Ground water Resources**

Dynamic Ground water resources of the district as on March 2009 were estimated by the GEC'97 methodology. The total annual ground water recharge from all sources is 84061 ham. After deducting the natural losses, the net annual groundwater availability of the district is 78110 ham. The existing ground water draft for irrigation, domestic and industrial use and the existing draft for all uses is 67,662 ham, 5517 ham and 73179 ham respectively. The ground water draft for domestic and industrial



Fig. 7

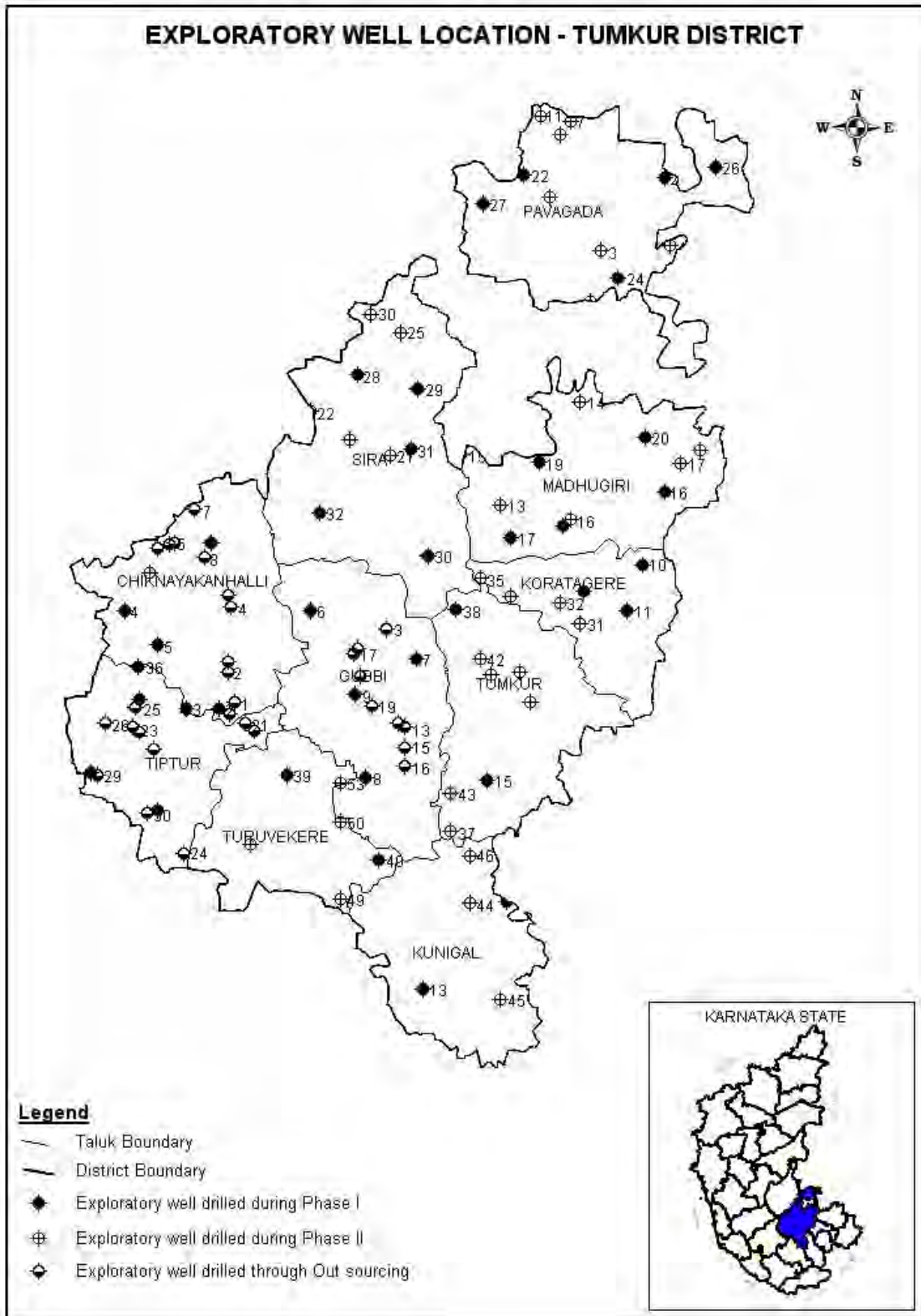
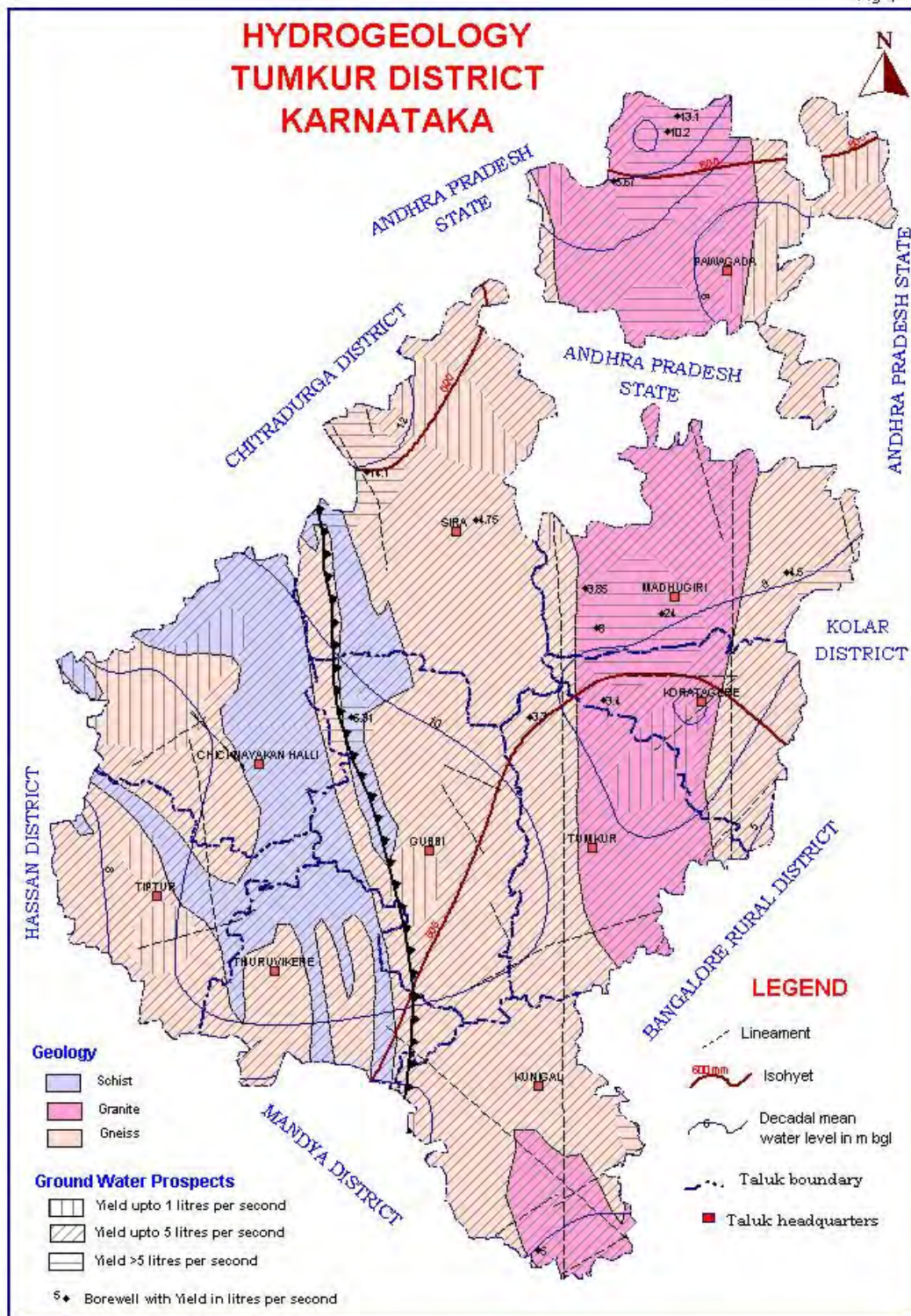


Fig.8



uses up to 2025 is 6949 ham. The net ground water availability for future irrigation development is 16357 ham which can create an irrigation potential of 21163 hectares. The stage of ground water development is 93.68%.

54.2% area of the district is overexploited, 3.5% critical, 10.3% semi critical and only 32% of the area is safe. Taluk wise ground water resources and categorization is given in table 3 and the status of utilization of ground water is shown in fig 9.

#### **4.9 Unit area annual ground water recharge**

Sustainability of ground water resource depends mainly on two factors viz. Annual ground water recharge and annual ground water draft. The annual ground water recharge depends on the quantity and intensity of rainfall, the infiltration characteristics of the soil, the depth to ground water level, the slope of the area and the geomorphology. The ground water recharge is assessed separately for the monsoon and non monsoon period due to rainfall as well as due to other sources which includes return seepage from irrigated area, seepage from canals, water bodies, influent rivers etc The total ground water recharge is expressed in meters which can be arrived at by dividing the total annual ground water recharge by the area. In Karnataka state ,the unit area recharge is grouped into four categories viz.0.025-0.10m,0.10-0.15m, 0.15-0.25, and 0.25-0.5m

In Tumkur district, the unit area annual recharge is in the range of 0.070m in Pavagada taluk and 0.103m in Tumkur taluk and the taluk wise details are given in the table 3. The low value in Pavagada is mainly due to low rainfall in the taluk when compared to other taluks. The taluk wise distribution of unit area annual ground water recharge is shown in fig 10

#### **4.10 Ground water Quality**

Water samples are collected from selected dug wells (National Hydrograph monitoring Stations) annually for chemical analysis. The analysis results indicate that in general the quality of ground water is potable for drinking and suitable for irrigation purposes. The Ph of ground water ranges from 7.43 to 8.4 indicates that the water is alkaline in nature. The electrical conductivity ranges from 375 at Madhugiri to 3380 us/cm at Hulyar. However in majority of the places it is less than 1500 us/cm. The Chloride concentration ranges from 14 to 466 mg/l. High chloride concentrations are observed in central part of Pavagada and Madhugiri taluks and in north western parts of Chiknayakanhalli taluk. However high concentration of fluoride (>1.5 mg/lit) is observed in northern part of Pavagada and Madhugiri taluks and as small patches in Sira taluk. High concentration of nitrates (>45 mg/lit) is observed in major parts of Pavagada, Sira, Madhugiri, Koratagere and central part of Chiknayakanhalli and western parts of Gubbi taluks. This may be attributed to unscientific way of disposal of domestic waste and more use of fertilizers.

#### **4.11 Status of ground water Development**

##### **4.11.1 Drinking water supply**

Bore wells are the major source of drinking water supply in the district .There are 15884 bore wells providing water supply to 5313 habitations. There are 911 piped

Fig.9

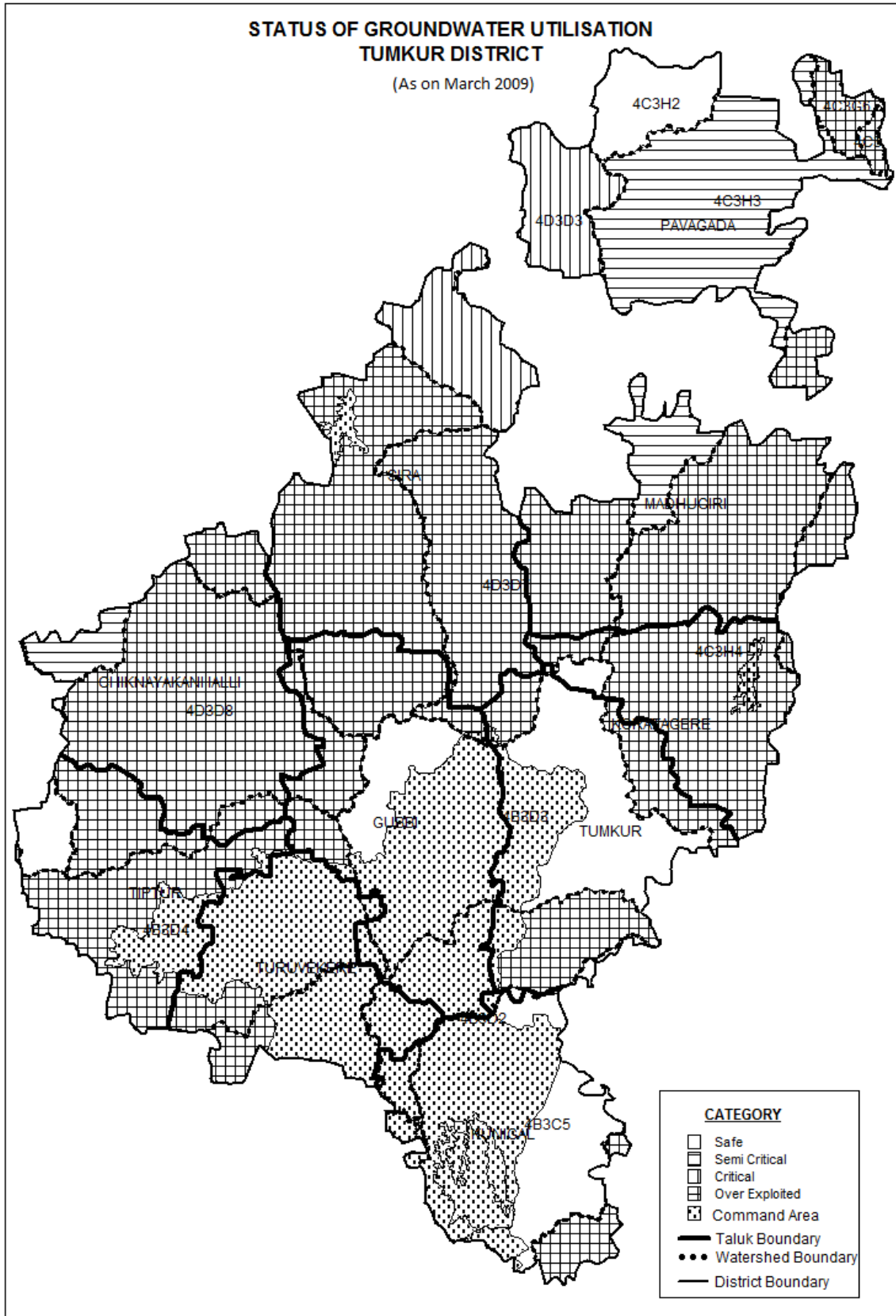
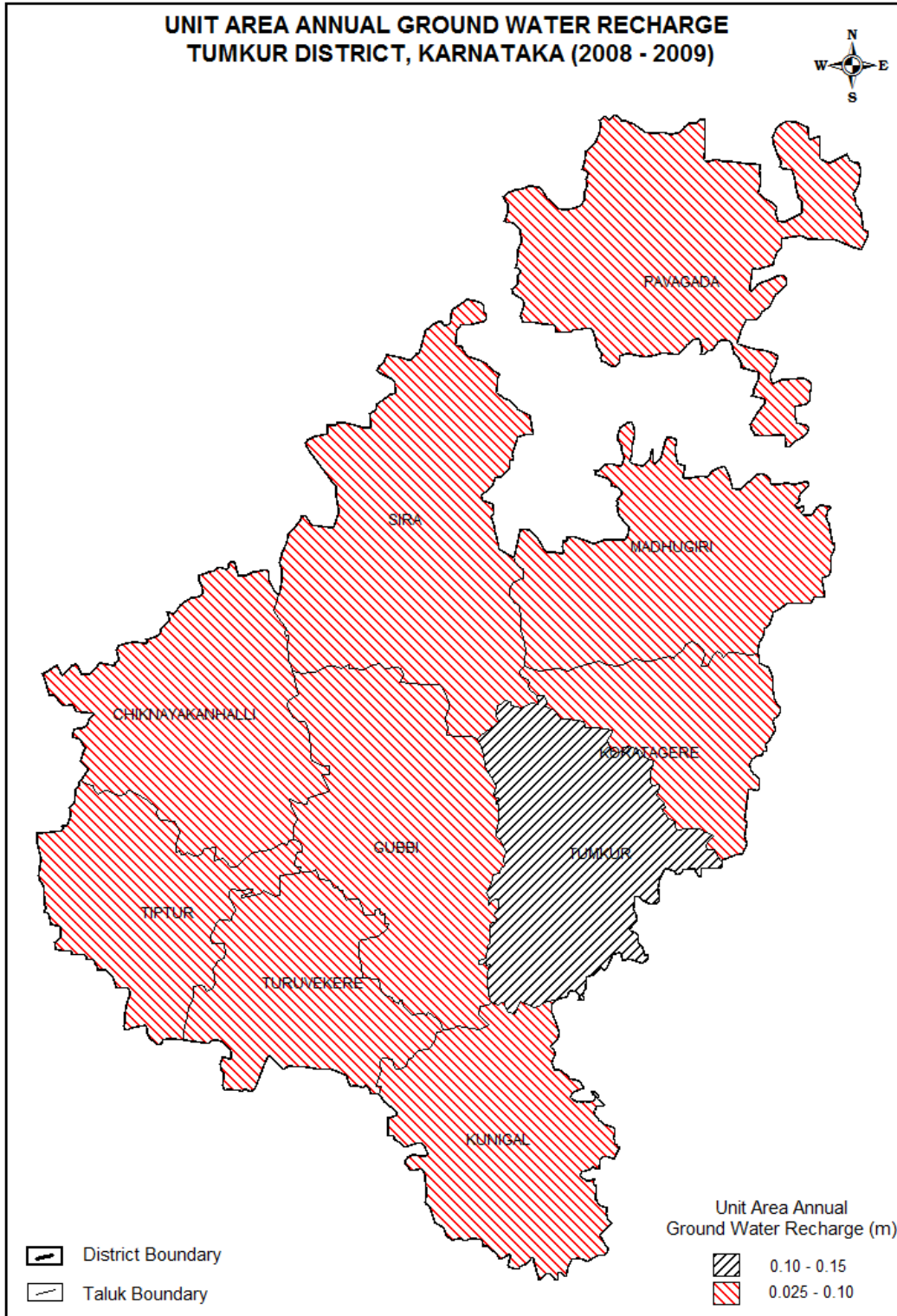




Fig. 10





water supply schemes and 3561 mini water supply schemes .The taluk wise details are given in the table 3 .

**Table 4: Taluk wise details of drinking water supply in Tumkur district (2011)**

Sl.no	Taluk	No of habitations	No of Bore wells	No of Piped Water supply schemes	No of Mini water supply schemes
1	Chiknayakanhalli	552	1140	87	236
2	Gubbi	725	2295	89	409
3	Koratagere	383	1035	70	267
4	Kunigal	755	2279	113	467
5	Madhugiri	457	1101	88	395
6	Pavagada	369	625	94	242
7	Sira	491	1745	114	405
8	Tiptur	391	1562	85	336
9	Tumkur	752	2314	100	501
10	Turuvekere	438	1788	71	303
<b>District Total</b>		<b>5313</b>	<b>15884</b>	<b>911</b>	<b>3561</b>

Out of 5313 habitations ,52% habitations having water supply of 40and above litres per capita per day(LPCD),25% habitations having water supply between 30 and 40LPCD, 17% habitations having water supply between 20 and 30LPCD, and only 6% habitations having water supply between 10 and 20LPCD.

#### **4.11.2 Irrigation water supply**

Ground water is the major source of water supply for irrigation in the district. Ground water sources-dug wells and bore wells irrigate 166909 ha out of total 193547 ha. Hence ground water irrigates 86% of the total irrigation. Between the dug wells and bore wells ,39556 dug wells irrigate only 1547 ha (1% ) where as 118107 bore wells irrigate 165362 ha(99% )showing the predominant role of bore wells in irrigation in the district. Each bore well on average grossly irrigate 1.4 ha where as the each dug well on average grossly irrigate meager 0.039 ha only. The taluk wise details are given in Table 5

**Table 5: Taluk wise details of irrigation by dug wells and bore wells in Tumkur district ( 2010)**

Sl.no	Taluk	Dug wells		Bore wells	
		Nos	irrigated area (ha)	Nos	Irrigated area (ha)
1	Chiknayakanhalli	2352	12	14011	13519
2	Gubbi	6543	235	21314	28036
3	Koratagere	613	--	5905	9856
4	Kunigal	2624	84	9837	6900
5	Madhugiri	9313	614	7564	16869
6	Pavagada	4806	60	3835	10616
7	Sira	6135	315	8524	19169
8	Tiptur	776	19	17088	20945
9	Tumkur	4396	---	17068	24152
10	Turuvekere	1998	208	12961	15300
<b>District Total</b>		<b>39,556</b>	<b>1547</b>	<b>1,18,107</b>	<b>1,65,362</b>

It is observed from the table that the gross area irrigated by 39556 dug wells is only 1547 ha. It is due to drying of the most of the dug wells. It is evident from the table even though there are 4396 dug wells in Tumkur taluk, and 613 dug wells in Koratagere taluk ,no area is irrigated in these taluks by dug wells.

## **5.0 Ground water Management Strategy**

### **5.1 Ground water Development**

Sustainability of ground water resource and its judicious use should be given prime importance while making development strategy. In critical and over exploited areas artificial recharge and rainwater harvesting measures are recommended to augment to ground water resources. About 16357 ham of ground water resource is available in the district for further development which can create 21,163 ha of additional irrigation potential. However the development is recommended only in areas categorised as safe and semi critical (Fig 9). In such areas potential aquifers can be located by hydrogeological surveys aided by geophysical methods. Filter points are recommended only in river and valley banks where sufficient thickness of valley fill is available which gets saturated during rainy seasons. Construction of collector wells would be the ideal structures in the alluvial tracts adjoining the river and nalla courses. Development in other feasible areas should be done by bore wells. Spacing norm of 200 m between the two bore wells may be strictly adhered to avoid interference.

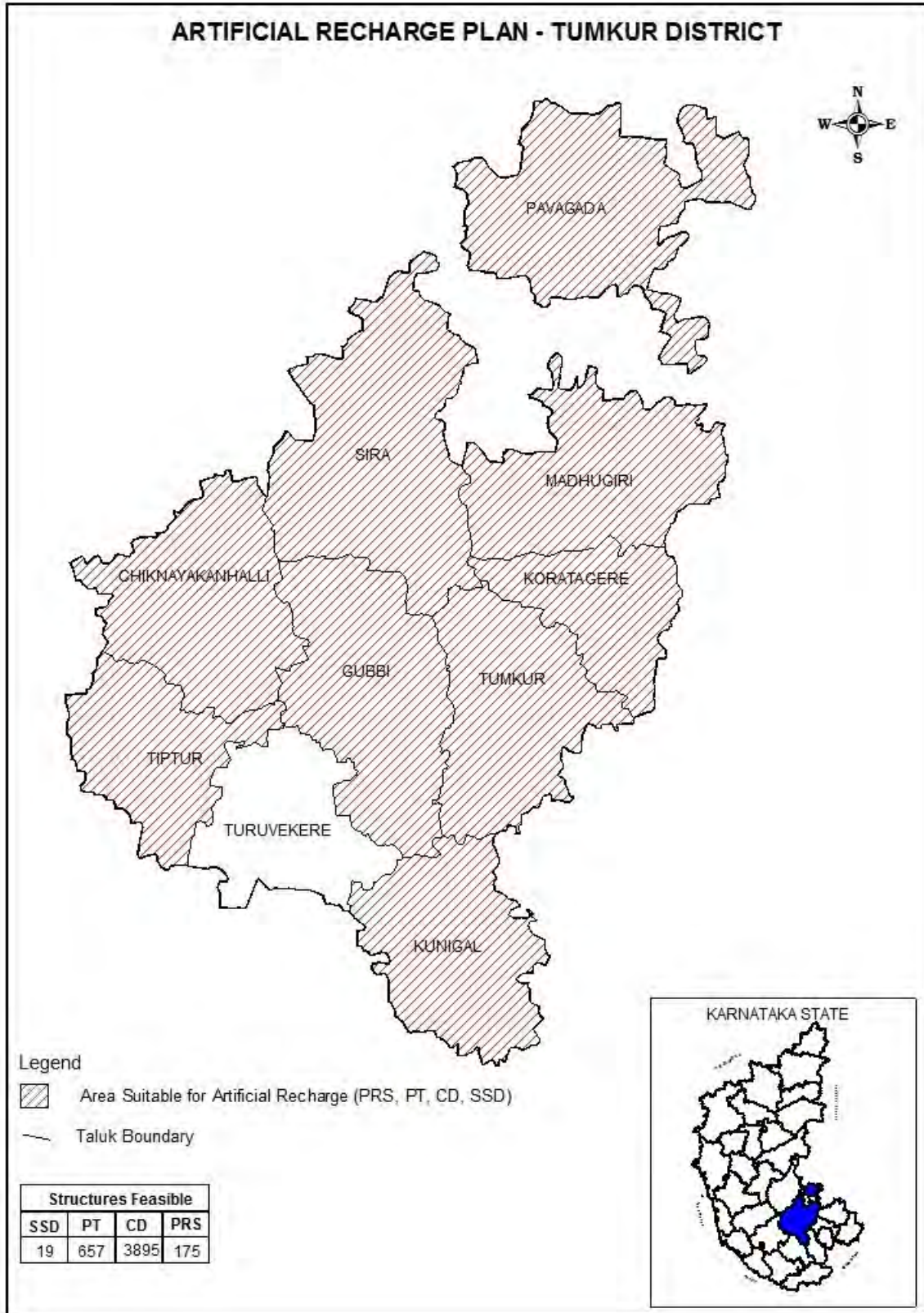
## 5.2 Water Conservation & Artificial Recharge

About 54.2 % of the area of the district is overexploited. All the taluks are having over exploited area with variable percentage of the area. The highest percentage of over exploited area is 96% in Koratagere taluk followed by 80% area in both Sira and Chiknayakanhalli taluks and 75% in Madhugiri taluk. The least over exploited is in Kunigal(1%) followed by 20% in Pavagada and 30% in Turuvekere taluk. In such a situation there is need to augment ground water recharge by artificial recharge structures and rainwater harvesting structures to harvest non-committal surface runoff. Taluk wise non-committed surface run off, feasible artificial recharge structures, their cost estimate and expected benefits are given in table 6. However it is recommended that over exploited and critical areas may be taken up on priority basis. 37.74 MCM of subsurface run off is available in the district. This can be harnessed by construction of 15 subsurface dyke, 87 percolation tanks, 290 check dams and 173 filter beds at an estimated cost of Rs 2770 lakhs. This will create an additional irrigation of 3139 hectares. The artificial recharge plan for Tumkur district is shown in fig11.

**Table 6: Feasibility of artificial recharge structures and their cost estimates in Tumkur district**

Taluk	Number of Proposed Recharge Structure				Cost of recharge Structures (Rs. In Lakhs)					Availability of surface non-committed runoff (MCM)	Recharge Capacity of each structure (MCM)				Total Recharge capacity (MCM)	Total Cost in Lakhs	Expected benefit of artificial recharge & RWH	
	Sub surface dyke	Percolation tank	Check dam	Filter Beds	Sub surface dyke (@Rs 4.5 lakhs)	Percolation tank (@Rs 20 lakhs)	Check dam (@Rs 2.4 lakhs) ***	Filter Beds (@Rs 1.5 lakhs)	Sub surface dyke		Percolation tank	Check dam	Filter Beds	Vol. of water likely to be recharged (MCM)			Additional Irrigation Potential (Hectares)	
C.N.HALLI	5	27	91	55	24.7	549	220	82	10.98	1.65	5.49	2.74	1.10	10.98	875.33	8.23	991.80	
GUBBI	4	21	69	41	18.6	413	165	62	8.26	1.24	4.13	2.07	0.83	8.26	658.80	6.20	746.46	
KORATAGERE	0	2	8	5	2.1	47	18.7	7	0.93	0.14	0.47	0.23	0.09	0.93	74.38	0.70	84.27	
KUNIGAL	0	0	0	0	0.1	1.3	0.51	0.2	0.03	0	0.01	0.01	0.00	0.03	2.02	0.02	2.28	
MADHUGIRI	1	7	24	14	6.4	142	56.6	21	2.83	0.42	1.42	0.71	0.28	2.83	225.75	2.12	255.79	
PAVAGADA	0	0	1	0	0.2	4.5	1.79	0.7	0.09	0.01	0.04	0.02	0.01	0.09	7.14	0.07	8.09	
SIRA	3	15	49	29	13.2	294	117	44	5.87	0.88	2.94	1.47	0.59	5.87	468.22	4.40	530.52	
TIPTUR	0	2	6	4	1.7	38	15.1	5.7	0.76	0.11	0.38	0.19	0.08	0.76	60.40	0.57	68.44	
TUMKUR	2	12	39	23	10.5	234	93.6	35	4.68	0.7	2.34	1.17	0.47	4.68	373.34	3.51	423.02	
TURUVEKERE	0	1	3	2	0.7	16	6.28	2.4	0.31	0.05	0.16	0.08	0.03	0.31	25.03	0.24	28.36	
	15	87	290	173	82.7	1758.8	694.58	261.5	34.74	5.2	17.38	8.69	3.48	34.74	2770.41	26.06	3139.03	

Fig. 11



Government of India sanctioned "National project for Repair, Renovation and Restoration (RRR) of water bodies which are directly linked to agriculture. The main objective is to restore and augment storage capacity of water bodies and also to recover and extend their lost irrigation potential. The RRR scheme is operational in Tumkur district.

## **6.0 Ground water related Issues & Problems**

There is over exploitation of ground water resource in 54.2% area of the district. This resulted in lowering of water levels.

Fluoride concentration of more than permissible limit exists in parts of Koratagere and Tumkur taluks.. Ground water in younger granites has more fluoride content than the gneisses. The fluoride content increases with depth in same aquifer. The shallow aquifers are having comparatively low concentration of fluoride. In order to reduce or control the problem, it is recommended to recharge ground water by way of artificial recharge structures like percolation tank, desilting of silted tanks, check dams, nalla bunds, farm ponds etc

Higher concentration of nitrate is noticed in parts of Pavagada, Sira, Chiknayakanhalli Tiptur, Madhugiri and Kunigal taluks.

Intensive irrigation and application of fertilizers/pesticides is noticed in Gubbi, Tumkur, Turuvekere and Kunigal taluks.

The area vulnerable to ground water contamination is shown in fig 12.

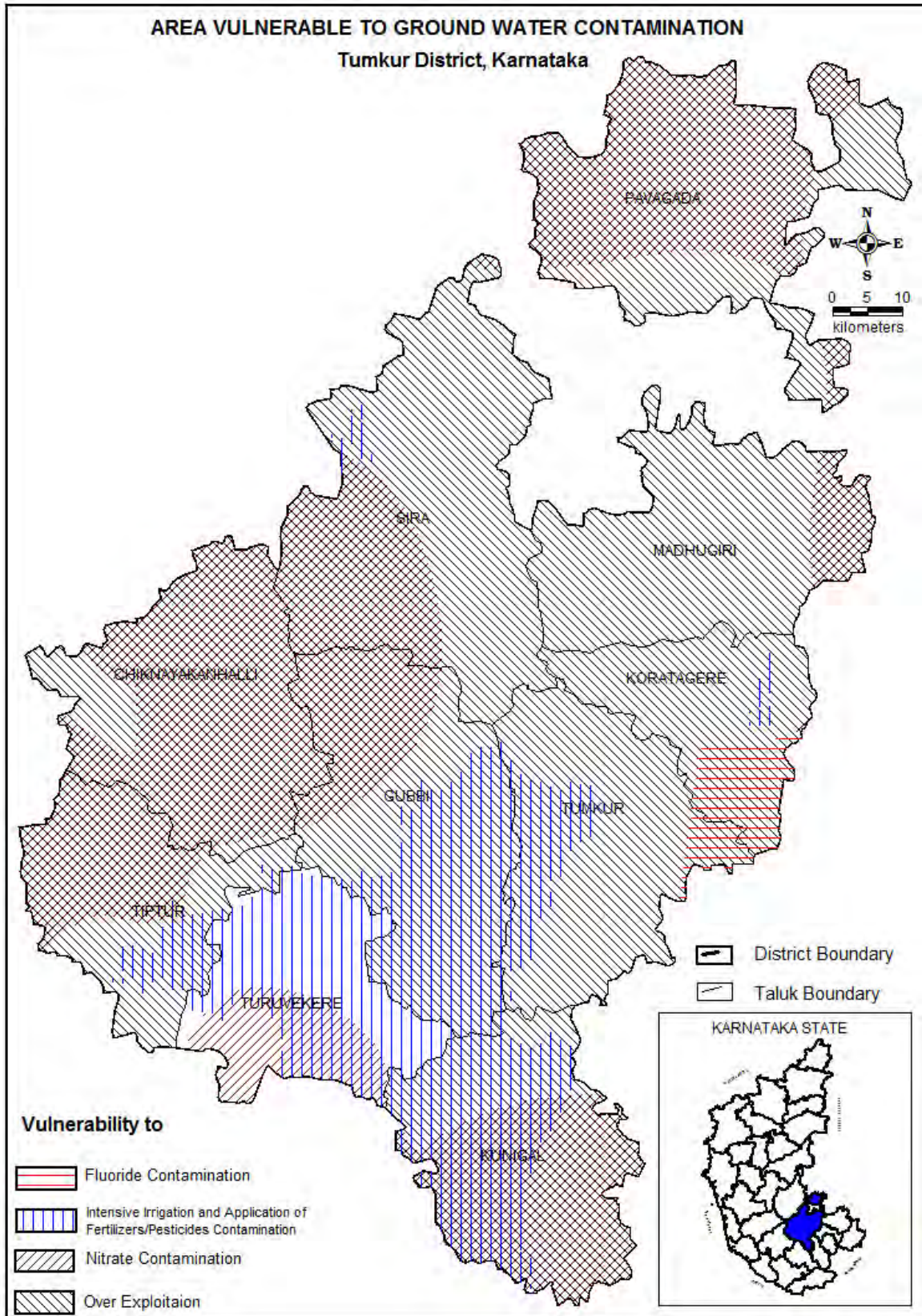
## **7.0 Awareness Training**

### **7.1 Mass awareness & Water Management Training Programmes**

Central Ground Water Board, SWR, Bangalore has organized " Mass awareness programme on use and conservation of Ground Water on 27.03.99 at Sira, Tumkur district as part of national level programme. The programme was well attended by administrators, local farmers. Display of slogans in local language (Kannada) highlighting to the attributes to ground water were arranged apart from technical maps, Reports, charts etc., pertaining to the area. Dr. Y.J.Pardhasaradhi, Regional Director presented a brief note on awareness programme and its aims and objectives, Shri. D.S.S.Murthy, Director, spoke on the availability of ground water in the state as well as in the country and the need to have awareness towards utilization of ground water. He also mentioned about the formation of Central Ground Water Authority and it's functioning. Dr. K.R.Sooryanarayana, Scientist CGWB spoke on use and conservation of ground water with a special reference to artificial recharge studies in the state. Representatives from local state Govt. departments expressed their views and experiences on the topic highlighting local problems and their solutions. Shri. Annayyappa, Asst. Development Commissioner of Sira, presided over the function. Shri. B.Nagaraj, Executive Officer taluk Panchayat was the chief guest apart from local elected representative. The function concluded highlighting the need for conservation of water to overcome the shortages. About 500 persons attended the programme.



Fig. 12





## **7.2 Participation in Exhibition, Mela, fair etc**

No exhibition was conducted in the district

## **8.0 Areas Notified by CGWA/SGWA**

No area in the district is notified so far

## **9.0 Recommendations**

Ground water is the major source for drinking and irrigation purposes. About 90% of the drinking requirements and 86% of irrigations requirements are met from ground water. This has resulted in over exploitation in about 54% area in the district.

1. There is decrease of potable water in fluoride-affected areas due to drying of phreatic aquifer. Hence to overcome these problems, it is recommended to adopt scientific management of ground water resource. Further development should be allowed only in areas, which are categorized as safe and semi critical with caution.

2. Mass awareness programmes should be conducted for public awareness about the limited availability of ground water resource.

3. Farmers should be educated to grow less water intensive crops and adopt micro irrigation system. Government should provide subsidy to such irrigation systems.

4. Artificial recharge structures should be constructed in feasible areas for augmenting ground water resource and to improve ground water quality especially in over exploited areas and quality affected areas in the district.

5. Sites for bore wells and dug wells should selected with the technical advice from technical qualified persons.

**TABLE 3.TALUK WISE GROUND WATER RESOURCES IN TUMKUR DISTRICT AS ON MARCH 2009**

TALUK	Area (sqkm)	TOTAL 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 2025	NET GROUND WATER AVAILABILITY FOR FUTURE IRRIGATION DEVELOPMENT	EXISTING STAGE OF GROUND WATER DEVELOPMENT	AVERAGE CROP WATER REQUIREMENT	BALANCE GROUND WATER IRRIGATION POTENTIAL AVAILABLE	STAGE OF DEVELOPMENT AS ON MARCH 2009				Unit Area Annual Ground Water recharge
											SAFE AREA (%)	SEMI-CRITICAL AREA (%)	CRITICAL AREA (%)	OE AREA (%)	
		HAM	HAM	HAM	HAM	HAM	HAM	%	(m)	ha					m
C.N.HALLI	1113	8201	10533	522	11055	528	69	149	0.85	81	2	18	-	80	0.073
GUBBI	1221	10381	3927	460	4387	633	5783	44	0.88	6571	40	-	-	60	0.085
KORATAGERE	652	4726	5181	544	5725	556	20	134	0.89	22	4	-	-	96	0.072
KUNIGAL	981	8262	4682	595	5277	1159	2060	67	0.47	4382	79	20	-	1	0.084
MADHUGIRI	1131	8109	7407	608	8015	657	310	109	0.82	378	-	25	-	75	0.071
PAVAGADA	1358	9637	5950	703	6654	838	2381	74	0.82	2903	20	40	20	20	0.070
SIRA	1552	12549	10187	628	10815	731	670	96	0.83	807	5	-	15	80	0.080
TIPTUR	785	5738	5980	459	6439	470	540	120	0.84	642	40	-	-	60	0.073
TUMKUR	1026	10641	10353	733	11086	902	2459	109	0.86	2859	60	-	-	40	0.103
TURUVEKERE	778	5817	3461	265	3726	475	2065	68	0.82	2518	70	-	-	30	0.074
TOTAL	1057	84061	67661	5517	73179	6949	16357	93.68	0.81	21163	32	10.3	3.5	54.2	0.079

