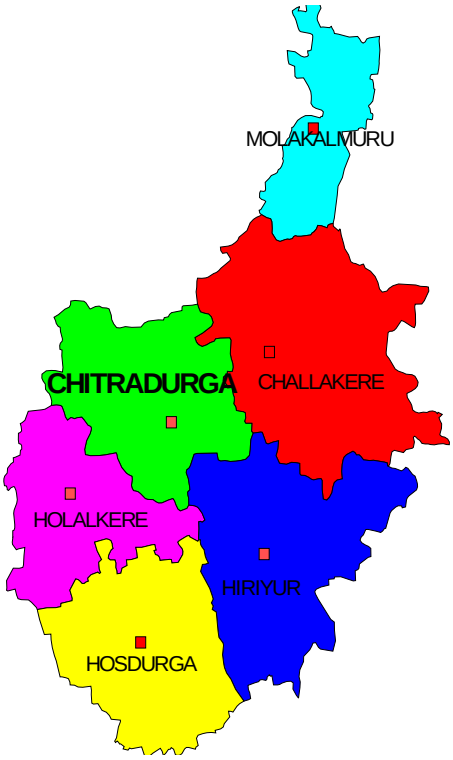
जल वर्ष 2007 Water Year 2007

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
CHITRADURGA DISTRICT, KARNATAKA STATE



SOUTH WESTERN REGION
BENGALURU
FEBRUARY 2013

सुशील गुप्ता
अध्यक्ष
केन्द्रीय भूमि जल बोर्ड,
जल संसाधन मंत्रालय,
भारत सरकार,
भूजल भवन, एन एच. - 4,
फरीदाबाद.

Sushil Gupta
Chairman
Central Ground Water Board,
Ministry of Water Resources,
Government of India,
Bhujal Bhawan, NH-IV,
Faridabad.

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.

Sushil Gupta
CHAIRMAN

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 Chitradurga 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 Dr K.Rajarjan, Assistant Hydrogeologist and under the guidance of Dr K.R.Sooryanarayana, Scientist-D, Central Ground Water Board, South Western Region, Bangalore. The figures were prepared by Sri.J.Sivaramakrishnan, Assistant Hydrogeologist. The efforts of Report Processing section in finalising and bringing out the report in this format are commendable.

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

(K.Md.Najeeb)
Regional Director

CHITRADURGA DISTRICT AT A GLANCE

Sl. No.	Items	Statistics
1.	**General Information**	
	(i) Geographical area (sq. km.)	8437
	(ii) Administrative Division (as in 2008 - 09)	
	(a) Number of Taluks	6 (Challakere, Chitradurga, Hiriyur, Holalkere, Hosadurga & Molkalmuru)
	(b) Number of Panchayats/ Villages	185 Gram Panchayats & 1059 villages
	(iii) Population (as per 2011 Census)	1660378
2.	**Geomorphology**	
	(i) Major physiographic units	Undulating terrain with long ranges. Low hillocks isolated in plain land.
	(ii) Major Drainage	Krishna main basin. Vedavathi, Janagahalli, Swarnamukhi & Yakanahalli Nalla sub – basin.
3.	**Land Use (sq. km.)**	
	(i) Forest area (ha)	73,719
	(ii) Net area sown (ha)	4,69,837
4.	**Major soil types**	Deep & shallow black soil, Mixed red & black soil, Red Loamy & sandy soil.
5.	**Irrigation by different sources (Areas & Numbers of structures) (as per Third Census of Minor Irrigation Schemes 2000-01)**	
	(i) Dug wells	451678 ha & 2314 No. of dug wells
	(ii) a. Shallow tube wells	(a) 833169 ha & 40839 No. of shallow tube wells.
	b. Deep tube wells	(b) 425 ha & 1 No. of deep tube well.
	(iii) Other sources: (a) Lift Irrigation Schemes	(a) 255896 ha & 106 No. of Lift irrigation schemes.
	(b) Surface Flow Irrigation	(b) 245766 ha & 157 No. of Surface flow irrigation schemes.

6.	**Number of ground water monitoring wells of Central Ground Water Board (as on 31.03.2012)**	
	(i) Dug wells	47
	(ii) Piezometers	12
7.	**Predominant Geological Formations**	Gneiss, Schist and granite.
8.	**Hydrogeology**	
	(i) Major water bearing formation	Gneiss & Granites (weathered & fractured)
	(ii) Pre-monsoon depth to water level during May 2011 (in mbgl)	0.0 to 20 range
	(iii) Post – monsoon depth to water level during Nov-2011 (in mbgl)	0 to 20 range
	(iv) Long term water level trend in 10 years (2001-2010) (a) Pre – monsoon; with reference to May-2011 (m) (b) Post – monsoon; with reference to November-2011 (m)	 (a) In general, the entire district is showing in raising trend. The western and eastern parts of the district is falling in 2 to 4 and above 4 m raising and rest of the area is showing raising trend of 0 to 2mts. (b) The district is showing 50% falling and rest 50 % raising trend water level.
9.	**Ground water exploration by Central Ground Water Board (as on 31.03.2012)**	
	(i) Number of wells drilled (EW, OW, PZ, SH, Total)	69 EW; OW-10,12 PZ
	(ii) Depth Range (mbgl)	27.43 to 200
	(iii) Discharge (litres per second)	0.04 to 29.09
	(iv) Transmissivity (m^2/day)	3.49 to 43.94
10.	**Ground water quality**	
	(i) Presence of chemical constituents more than permissible limit	Fluoride, Nitrate & pesticide
11.	**Dynamic ground water resource (2004) (in mcm)**	
	(i) Annual replenishable ground water resource (ham)	50364
	(ii) Net Annual Ground Water Draft (ham)	50777
	(iii) Projected demand for domestic & industrial uses upto 2025 (ham)	5149.90
	(iv) Stage of ground water development (%)	106
12.	**Awareness & Training activity**	
	(i) Mass awareness programmes organized	
	(a) Date	30.03.05
	(b) Place	Dallara Bhavan, Challakere taluk.

	(ii) Water management Training Programmes organized	
	(a) Date	19th & 20th January 2005
	(b) Place	Zilla Panchayat office, Chitradurga
13.	**Artificial recharge & rainwater harvesting**	
	(i) Projects completed by CGWB (No. & amount spent)	Nil
	(ii) Projects under technical guidance of CGWB	Nil
14.	**Ground water control & Regulation**	
	(i) Number of OE blocks	5 (Except Molakalmuru)
	(ii) Number of Critical blocks	Nil
	(iii) Number of blocks notified	Nil

GROUNDWATER INFORMATION BOOKLET
CHITRADURGA DISTRICT, KARNATAKA

1.0 INTRODUCTION

Groundwater availability in hard rock formation is mainly depending on secondary porosity such as fractures, joints and weak planes. The quantity of groundwater in the water bearing formation (aquifers) depends on the fractures opening, intersection and intensity. Identification of groundwater potential/fractures zones in hard rock formation is still making a challenging job. The conventional approach to find out potential zones is always surface and sub-surface investigation which includes remote sensing techniques, hydrogeological conditions, historical and geophysical investigation. Based on the all the integrated informations, the ground water conditions of the hard rock formation is revealed and Groundwater information booklet has been prepared for Chitradurga district which gives brief information about the groundwater scenario of the areas.

Chitradurga district falls in central eastern parts of the state and covers a total geographical area of 8388 sq.kms. It is bounded by Tumkur, Chickmaglur, Davanegere, Bellary districts except Andhra Pradesh state in east. Administratively, the district is divided into six taluks namely Chitradurga, Hiriyur, Holalkere, Hosadurga, Challakere and Molkalmuru (**Figure 1**). It receives low to moderate rainfall and is one of the drought prone districts in the state. Normal annual rainfall varies between 668mm in Holalkere in western part to 457mm in Chellakere in the northeastern part. As Holalkere and Hosadurga taluks falls fringe of Western Ghats, these areas experience highest rainfall as compared to away from Western Ghats taluks.

Vedavathi River basin covers maximum areas in the district and it is tributary of Tungabhadra River. The Vanivilasa Sagar a reservoir is built across the Vedavathi River, at Vanivilaspura in Hiriyur taluk. The canal network of the reservoir provides irrigation facilities to area in Hiriyur taluk and also supplying drinking water to Hiriyur city. In addition to this, (1) Gayathri Reservoir, (2) Rangayanadurga Reservoir and (3) Narayanapura Anicut are irrigation projects commissioned in the district(**Figure 2**). The drainage

pattern is dendrite to sub-dendrite and at places trellis located in the structurally controlled streams. The drainage density varies from 0.72 to 1.70 km/km^2 and general ground elevation ranges from about 500 m to 800 m amsl. Agriculture is main source of income in the district.

Central Ground Water Board has carried hydrogeological studies in 1972-75, 1974-80, 1989-1992, 2003-2005 & 2006-2008 under various projects. Thirty numbers of bore wells were drilled, by CGWB, through outsourcing under drought mitigation projects.

2.0 RAINFALL

The normal annual rainfall in the district based on 30years is 574mm. However, in the last decade (1996-2005) the district received an average annual rainfall of 631.7mm. Further analysis of rainfall data (**Table 1**) indicate that deficient rainfall occurred in the years 2003, whereas the year 2005 received excess rainfall. The taluks of Chellakere & Chitradurga faced deficit rainfall in the years of 2002 & 2004 as well but other taluks had deficit rainfall during two successive years 2002 and 2003. Post-monsoon rainfall had failed in the district during 2001 and 2004. During the year 2003 the pre- and post-monsoon season, rainfall had failed. Lowest rainfall occurred in Challakere where as highest in Hosadurga taluks.

Table 1.Taluk wise annual rainfall (in mm)

Year	Challakere	Chitradurga	Hiriyur	Holalkere	Hosadurga	Molkalmur
1999	523.9	558.2	516.9	566.4	881.7	518.6
2000	525.0	756.4	716.7	680.6	881.4	431.4
2001	490.7	493.7	561.8	481.4	454.2	486.0
2002	331.6	424.0	470.1	583.1	402.8	451.6
2003	295.3	387.3	292.1	406.7	371.3	223.4
2004	477.6	599.3	488.3	627.3	645.8	431.3
2005	719.6	849.3	852.3	952.2	733.2	661.1
2006	359.1	496.4	421.7	593.9	547.5	337.0
2007	560.7	686.0	786.5	672.3	644.7	780.0
2008	660.9	680.5	639.7	642.5	666.4	541.2
Average	**494.44**	**593.11**	**574.61**	**620.64**	**622.9**	**486.1**

Fig-1

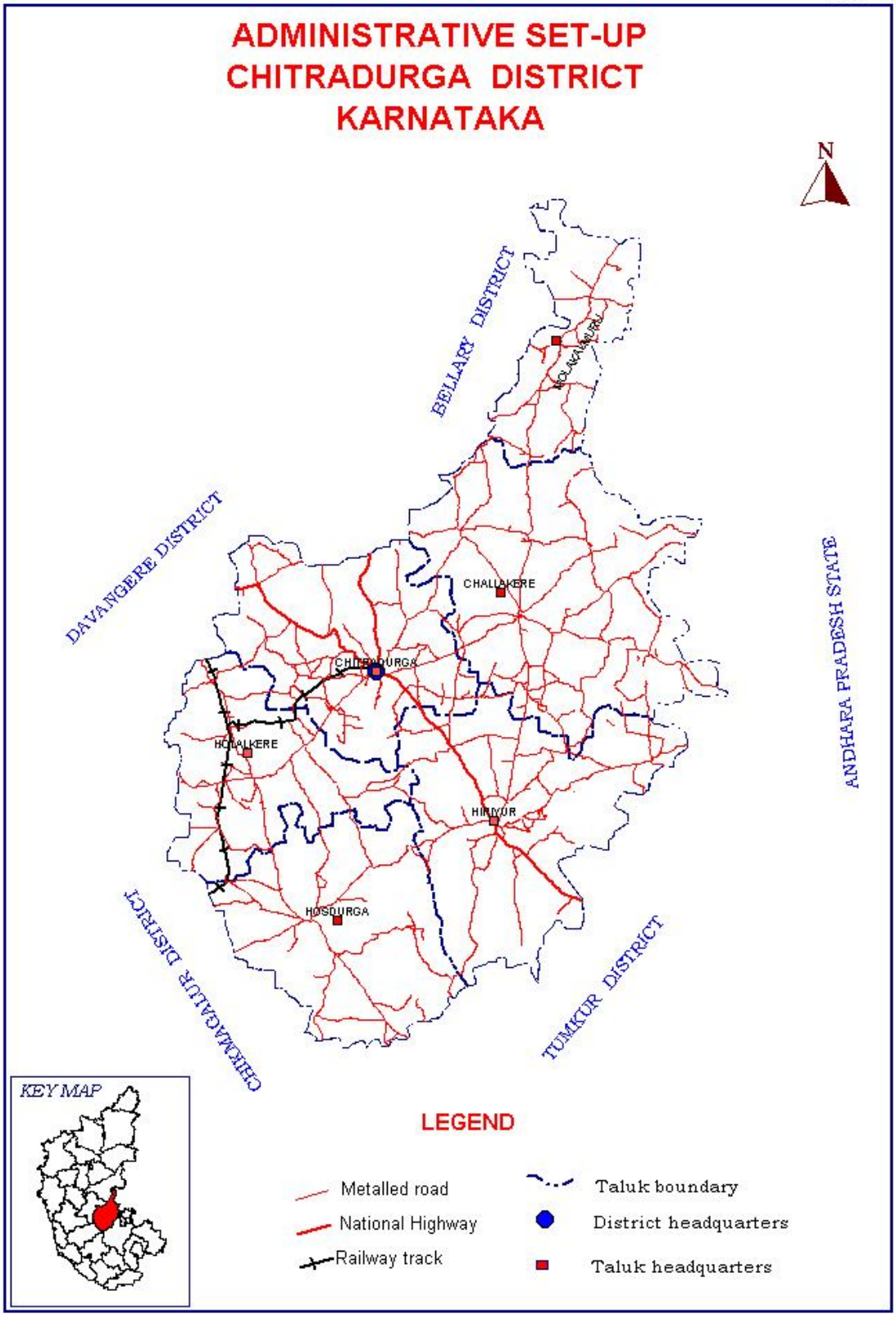
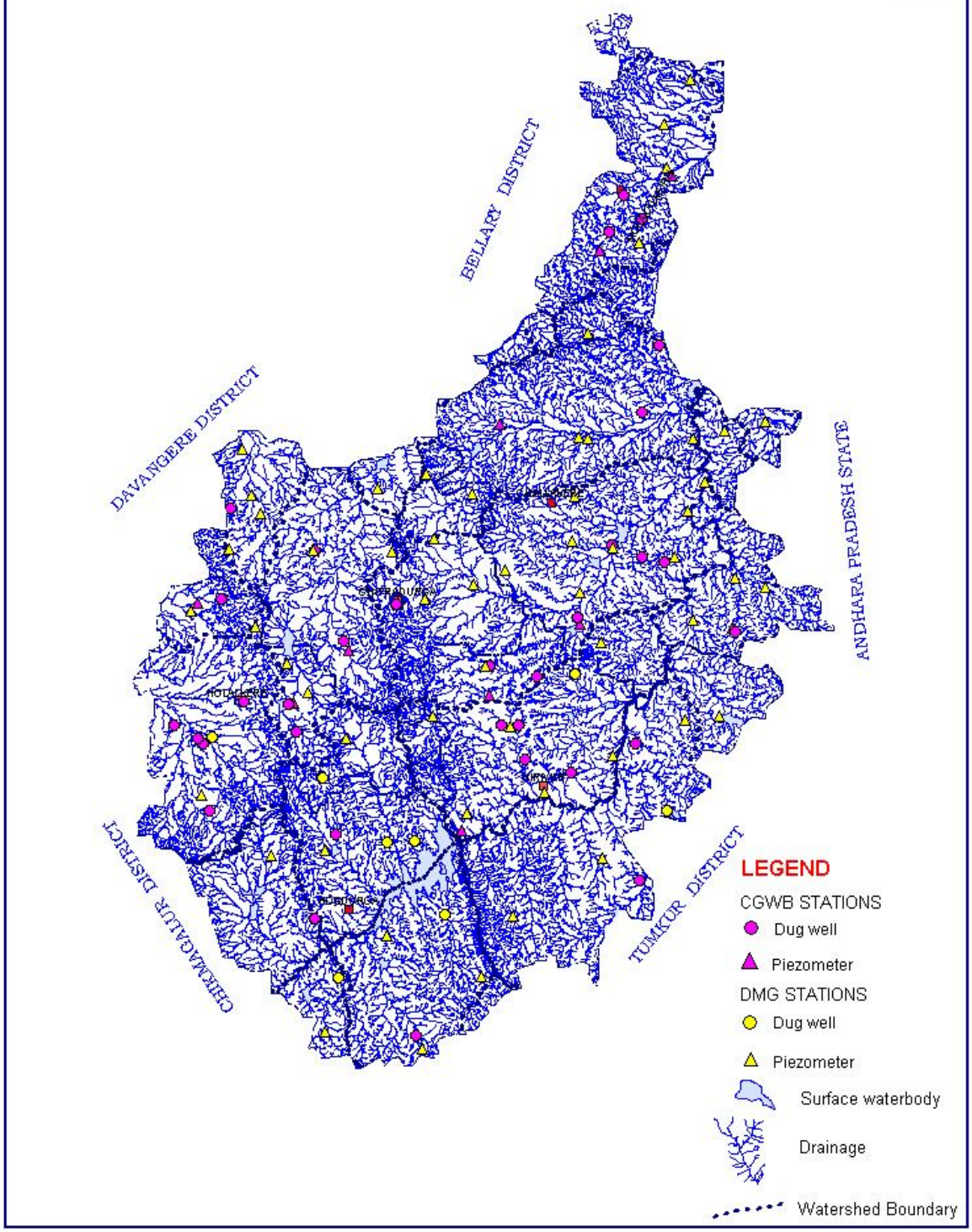

ADMINISTRATIVE SET-UP
CHITRADURGA DISTRICT
KARNATAKA
N
BELLARY DISTRICT
KOLAVAGURU
DAVANGERE DISTRICT
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
ANDHRA PRADESH STATE
CHIKMAGALUR DISTRICT
TUMKUR DISTRICT
KEY MAP
LEGEND
Metalled road
National Highway
Railway track
Taluk boundary
District headquarters
Taluk headquarters

Fig-2

DRAINAGE & HYDROGRAPH MONITORING STATIONS
CHITRADURGA DISTRICT, KARNATAKA



3.0 GEOMORPHOLOGY & SOIL TYPE

Soil types of the district comprise deep & shallow black soil, mixed red & black soil, red loamy & sandy soil. Physiographically, the district comprises of undulating plains, interspersed with sporadic ranges hillocks.

4.0 GROUND WATER SCENARIO

4.1 HYDROGEOLOGY

Groundwater occurs under phreatic condition in the weathered rock of Peninsular Gneissic complex which comprising of Granites, gneisses, Schist and Younger granite (**Figure 3**). The thickness of weathered zone varies from less than a meter near hill slopes and higher altitudes to about 39 m in valleys and topographic low areas. At depth, the groundwater occurs in the fractures and fault zone of these crystalline rocks under semi-confined to confined conditions.

In **Molakalmur** taluk, granites, granitic-gneisses and amphibolite-gneisses are the main water bearing formations. Ground water exploration reveals the existence of 3 to 5 potential fracture zones having a thickness ranging from 1 to 10 m occurring between the depths of 30 to 200 mbgl (**Figure 4**).Exploratory bore wells drilled depth are ranging from 133.15 to 200 mbgl. Depth of weathered zone ranges from 12.3m to 24 mbgl. Yeild ranges from<1.0 to 7.1lps.Transmisivity ranges from 9.84 m^2/day to 26.22 m^2/day. Specific Capacity ranges from 9.84 lpm/m to 26.22 lpm/m.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling in 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 2 to 5mts zone (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**)water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00 mts zone. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is falling in raising and falling water level of between 0.00 to 2.00 mts occuring in eastern and western parts of the taluk respectively.

In **Chitradurga** taluk fractured granitic-gneisses, gneisses and hornblende-schists are the main water bearing formations. Ground water exploration reveals that aquifers are encountered between the depths of 15 mbgl and 192 mbgl. Bore wells drilled depth in the taluk ranges from 105.34 mbgl to 200 mbgl. Depth of weathered zone range from 5.52m to 2.61mbgl.Yeild ranges from 0.04 to 5.42 lps. Transmissivity ranges from 2.37 to 40.84m^2/day. Specific capacity ranges from 4.53 to 43.94 lpm/m draw down.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling in 2 – 5 and 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 2 to 5mts zone (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**) water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00 and 2.00 to 4.00 mts zone. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00 mts.

In **Holalkere** taluk, gneisses, schists and greywackes are the main water bearing formations. Ground water occurs within the weathered and fractured rocks. Ground water occurs under water-table condition and semi-confined condition. Ground water exploration reveals that aquifers were encountered between 25 mbgl to 169 mbgl. Bore wells drilled depth in the taluk is ranging from 123.66 mbgl to 200mbgl. Depth of weathered zone ranges from 11.5 to 30.3 mbgl. Yield ranges from 0.04 to 6.3 lps.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling in 2 – 5 and 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 0 to 2 and 2 to 5mts zones (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**) water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00, 2.00 to 4.00 and >4 mts zones. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00 and 2.00 – 4.00 mts. Very small area of the taluk is showing the falling zone of 0 to 2 mts.

In **Challakere** taluk, gneisses, granitic-gneisses and amphibolites are the main water bearing formations. Ground water occurs within the weathered and fractured rocks. Ground water exploration reveals that aquifer systems are encountered from depth15.4 mbgl to 182.9 mbgl. Bore wells drilled depth in the taluk is ranging from 118.82 mbgl to 200 mbgl. Depth of weathered zone ranges from 5.32 to 20.64 mbgl. Yield ranges from 0.21 to 8.23lps. Transmissivity ranges from34.50 to 665.17 m^2/day.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling in 2 – 5 and 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 2 to 5mts and 5 to 10mts zones (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**) water level data is indicating that the taluk is falling in raising water level of between 0.00 to 2.00mts zone. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is occurring in falling water level of between 2.00 – 4.00 mts zone. Nearly half of area of the taluk is showing the rising zone of 2 to 4 and >4 mts.

In **Hosadurga** taluk granitic-gneisses, and schists are the main water bearing formations. Ground water occurs within the weathered and fractured granitic-gneisses and schists under water-table condition and semi-confined condition. Bore wells drilled depth in the taluk is ranging 64 mbgl to 200.1mbgl. Depth of weathered zone ranges from 6.0mbgl to 27.0 mbgl. Yield ranges from 0.64 to 5.5 lps. Transmissivity ranges from 0.5 m^2/day to 75.88 m^2/day. Storativity ranges from0.07 to 0.21.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 5 to 10mts zones (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**) water level data is indicating that the taluk is falling in rising water level of between 0.00 to 2.00mts zone. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is occurring in falling water level of between 0.00 to 2.00 and 2.00 – 4.00 mts zone.

Fig-3

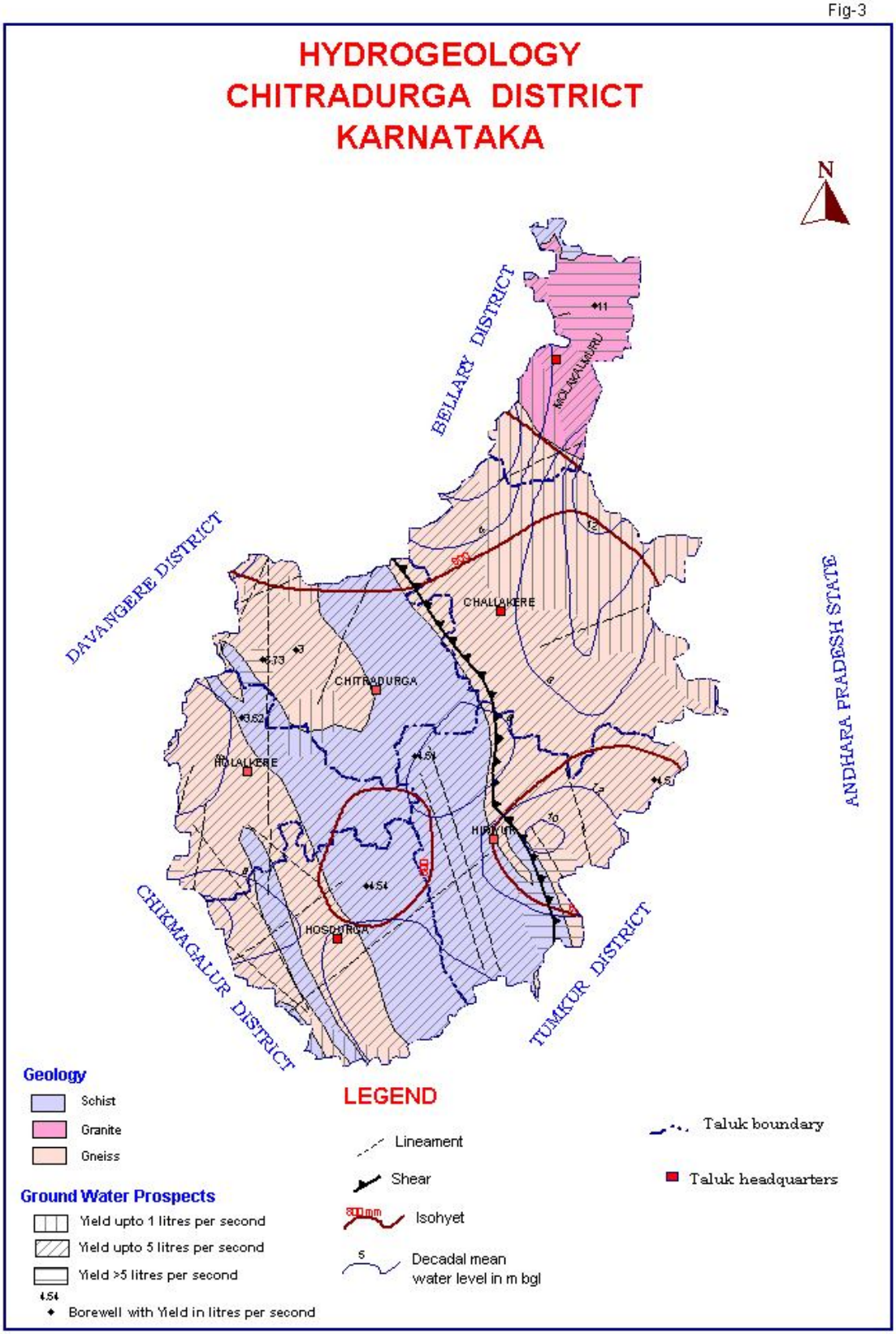

HYDROGEOLOGY
CHITRADURGA DISTRICT
KARNATAKA
N
BELLARY DISTRICT
DAVANGERE DISTRICT
ANDHARA PRADESH STATE
CHIKMAGALUR DISTRICT
TUMKUR DISTRICT
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
Geology
Schist
Granite
Gneiss
Ground Water Prospects
Yield upto 1 litres per second
Yield upto 5 litres per second
Yield >5 litres per second
4.54
Borewell with Yield in litres per second
LEGEND
Lineament
Shear
Isohyet
Decadal mean
water level in m bgl
Taluk boundary
Taluk headquarters

Fig-4

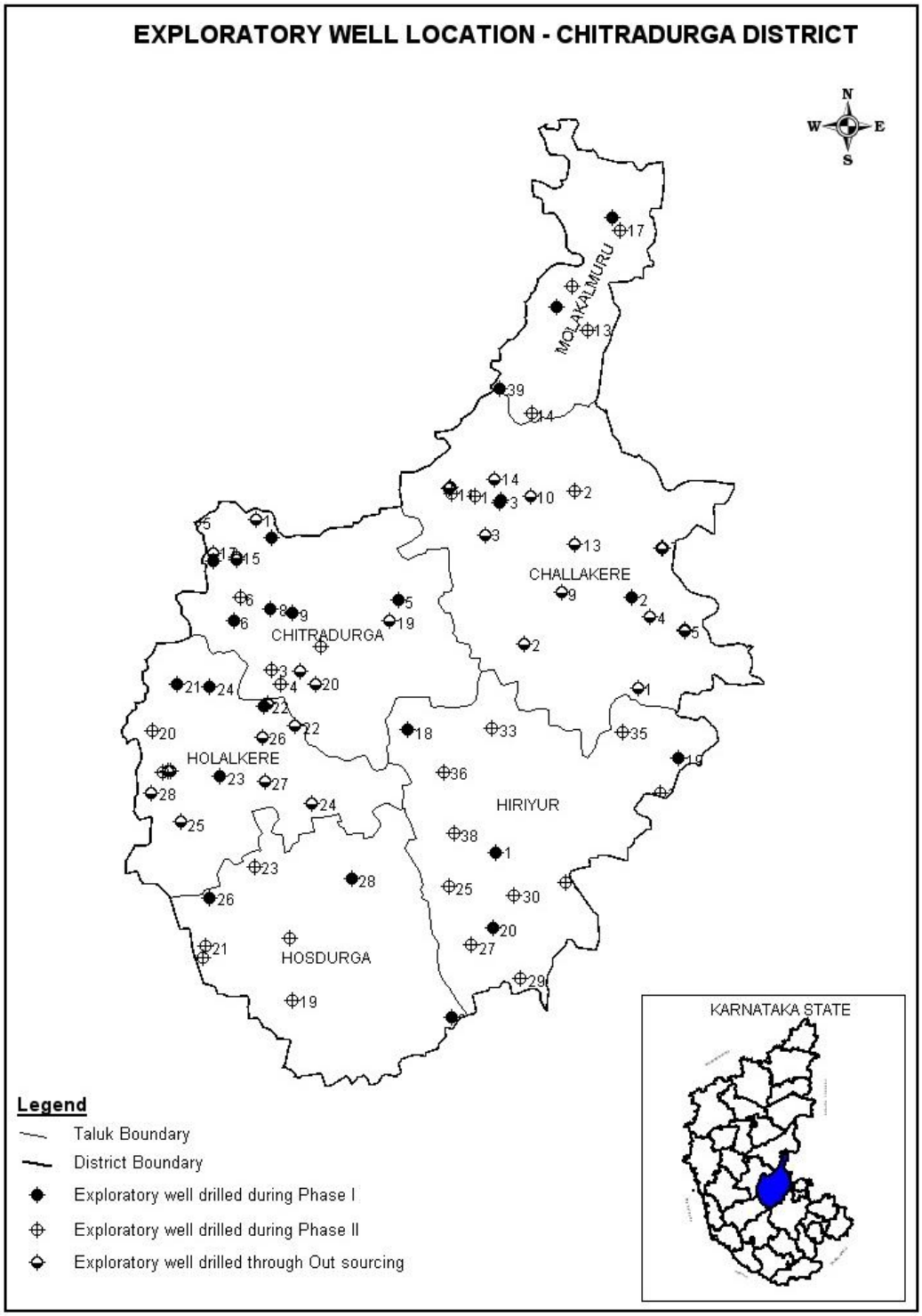

EXPLORATORY WELL LOCATION - CHITRADURGA DISTRICT
N
W
E
S
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
KARNATAKA STATE
Legend
Taluk Boundary
District Boundary
Exploratory well drilled during Phase I
Exploratory well drilled during Phase II
Exploratory well drilled through Out sourcing

Fig-5

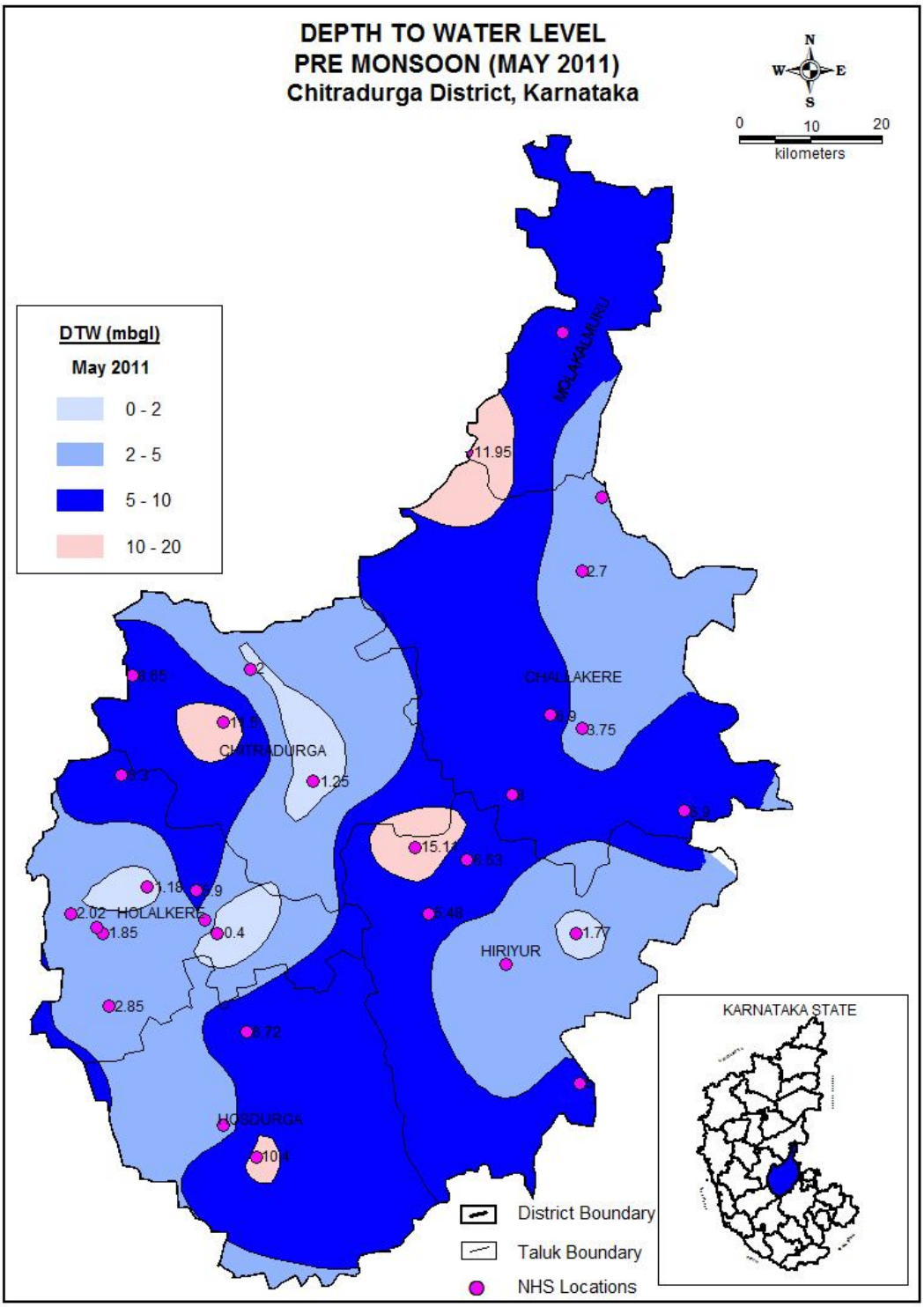
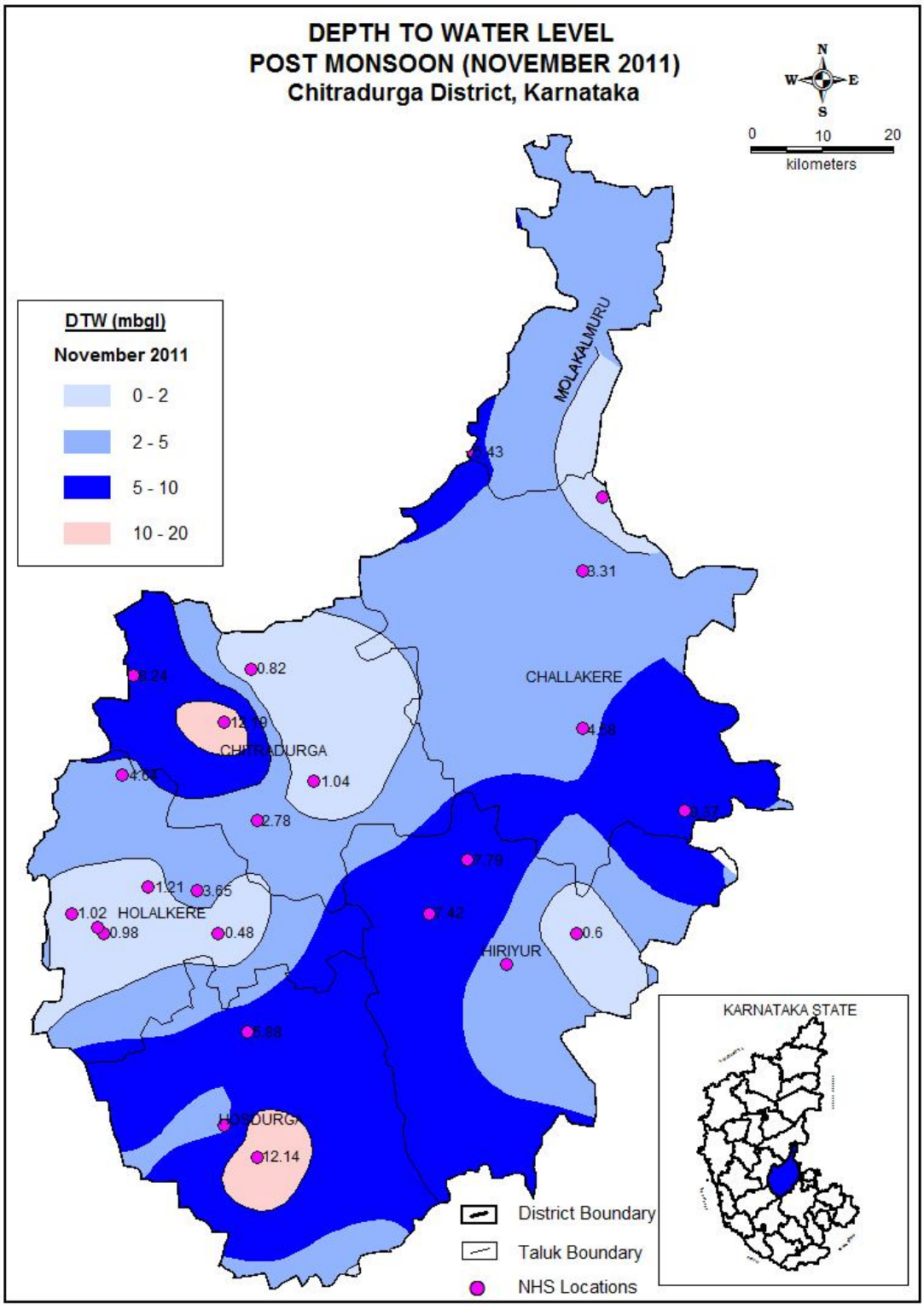

DEPTH TO WATER LEVEL
PRE MONSOON (MAY 2011)
Chitradurga District, Karnataka
N
W
E
S
0
10
20
kilometers
DTW (mbgl)
May 2011
0 - 2
2 - 5
5 - 10
10 - 20
MOLAKALMURU
11.95
2.7
CHALLAKERE
3.75
CHITRADURGA
1.25
15.1
1.18
2.02
HOLALKERE
1.85
0.4
5.48
1.77
HIRIYUR
2.85
HOSDURGA
District Boundary
Taluk Boundary
NHS Locations
KARNATAKA STATE

Fig-6


DEPTH TO WATER LEVEL
POST MONSOON (NOVEMBER 2011)
Chitradurga District, Karnataka
N
W
E
S
0
10
20
kilometers
DTW (mbgl)
November 2011
0 - 2
2 - 5
5 - 10
10 - 20
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
3.31
0.82
1.04
2.78
1.21
3.65
1.02
0.98
0.48
0.6
12.14
KARNATAKA STATE
District Boundary
Taluk Boundary
NHS Locations

In **Hiriyur** taluk, granitic-gneisses and schists are the main water bearing formations. Ground water occurs within the weathered and fractured granitic-gneisses and schists under water table condition and semi-confined condition. Bore wells drilled depth in the taluk is ranging from 60 mbgl to 88.90mbgl. Depth of weathered zone ranges from 1.6 mbgl to 13.52 mbgl. Yield ranges from 1.11 lps to 4.54 lps. Transmissivity ranges from 4.44 m^2/day to 83.7 m^2/day.

May 2011 (pre-monsoon) depth to water level indicates that maximum area of taluk is falling 2-5 and 5-10mts (**Figure 5**) whereas in November 2011 (post-monsoon) water level is falling in 0 to 2, 2 to 5 and 5 to 10mts zones (**Figure 6**). The decadal mean pre-monsoon (May2001-2010 with reference to May-2011) (**Figure 7**) water level data is indicating that the taluk is falling in rising water level of between 0.00 to 2.00 and 2 to 4 mts zones. The decadal mean post-monsoon (November 2001-2010 with reference to November-2011) (**Figure 8**) water level data is indicating that the taluk is occurring in falling water level of between 0.00 to 2.00 and 2.00 – 4.00 mts zone. Very small parts of the area are falling in rising water level of 0 to 2mts zone.

4.2 Ground Water Resources

The resource estimation and categorization is carried out as per the recommendations of GEM-97. As per ground water resource estimation studies (GEM-97), the district is over exploited with a groundwater draft of 53777 ham as against the available resource of 50364 ham thus the stage of ground water development in the district is 106% (**Table-2)**. Major part of the district is falling under over-exploited category (**Figure 9**). However, some parts of the district fall in parts of safe watershed where there is scope for further development.

Fig-7

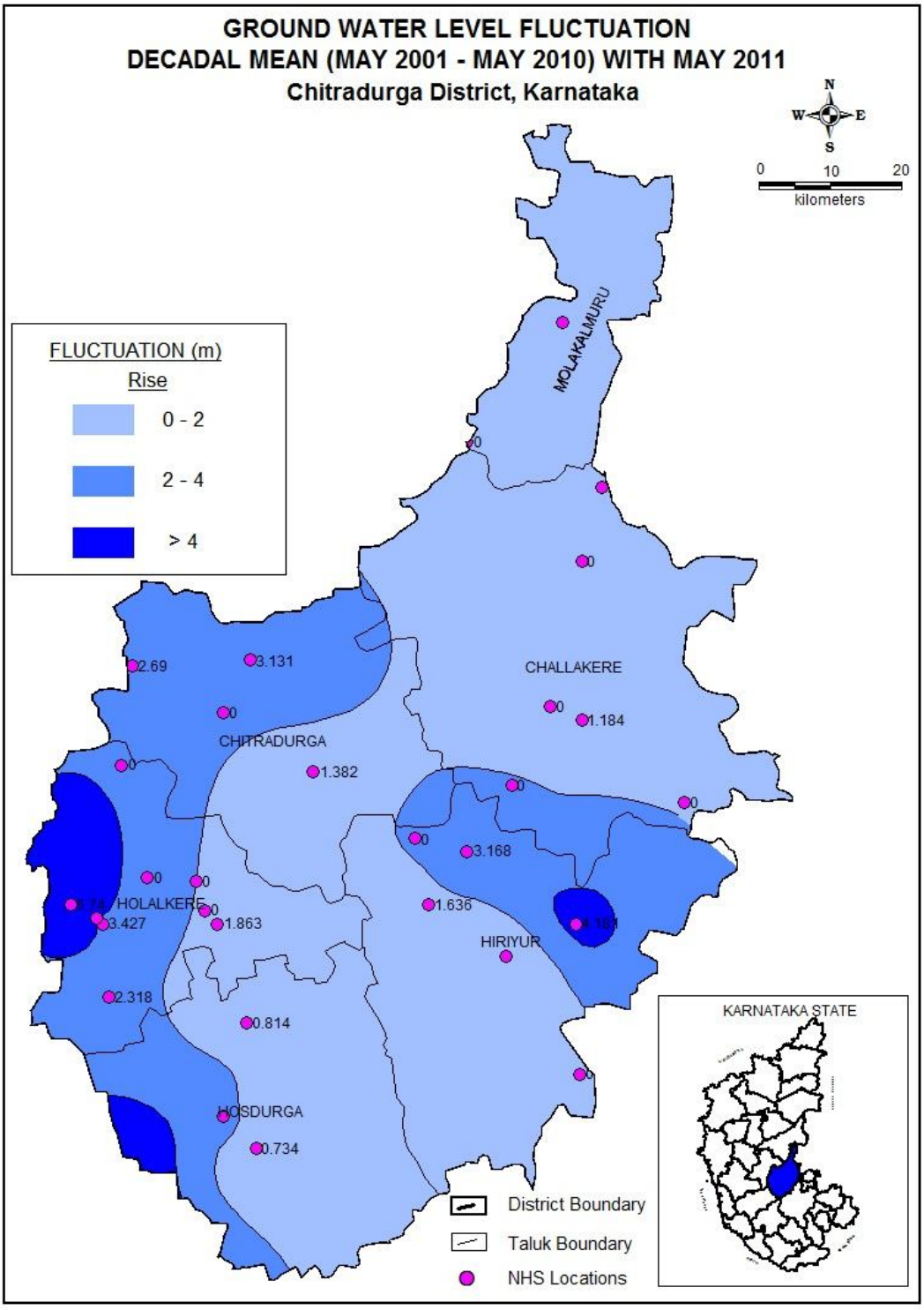
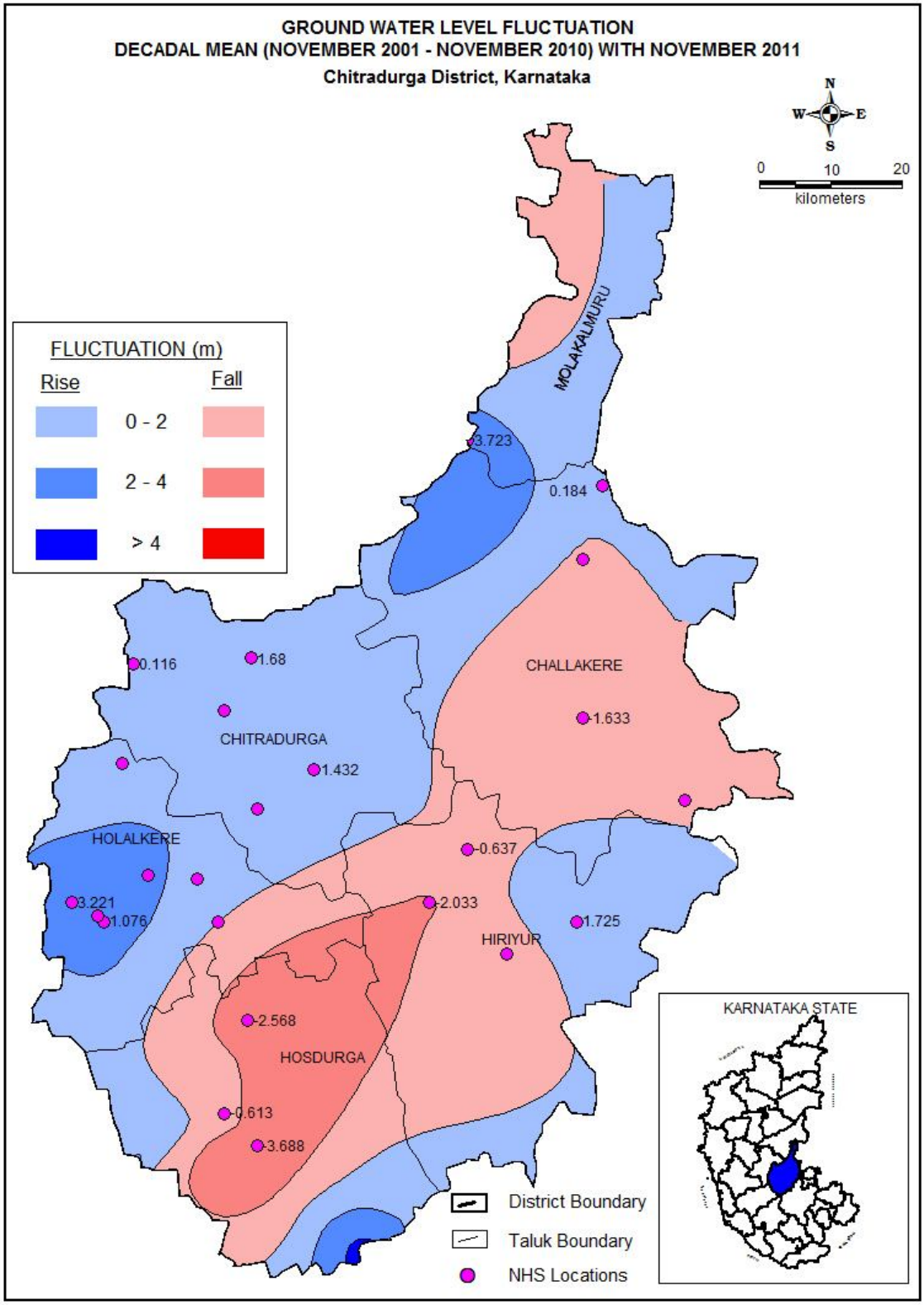

GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (MAY 2001 - MAY 2010) WITH MAY 2011
Chitradurga District, Karnataka
N
W
E
S
0
10
20
kilometers
FLUCTUATION (m)
Rise
0 - 2
2 - 4
> 4
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
2.69
3.131
1.184
1.382
3.168
1.636
3.427
1.863
2.318
0.814
0.734
KARNATAKA STATE
District Boundary
Taluk Boundary
NHS Locations

Fig-8


GROUND WATER LEVEL FLUCTUATION
DECADAL MEAN (NOVEMBER 2001 - NOVEMBER 2010) WITH NOVEMBER 2011
Chitradurga District, Karnataka
N
W
E
S
0
10
20
kilometers
FLUCTUATION (m)
Rise
Fall
0 - 2
2 - 4
> 4
MOLAKALMURU
-3.723
0.184
0.116
1.68
CHALLAKERE
1.633
CHITRADURGA
1.432
HOLALKERE
-0.637
3.221
1.076
-2.033
1.725
HIRIYUR
-2.568
HOSDURGA
0.613
3.688
District Boundary
Taluk Boundary
NHS Locations
KARNATAKA STATE

4.3 Status of Ground Water Development

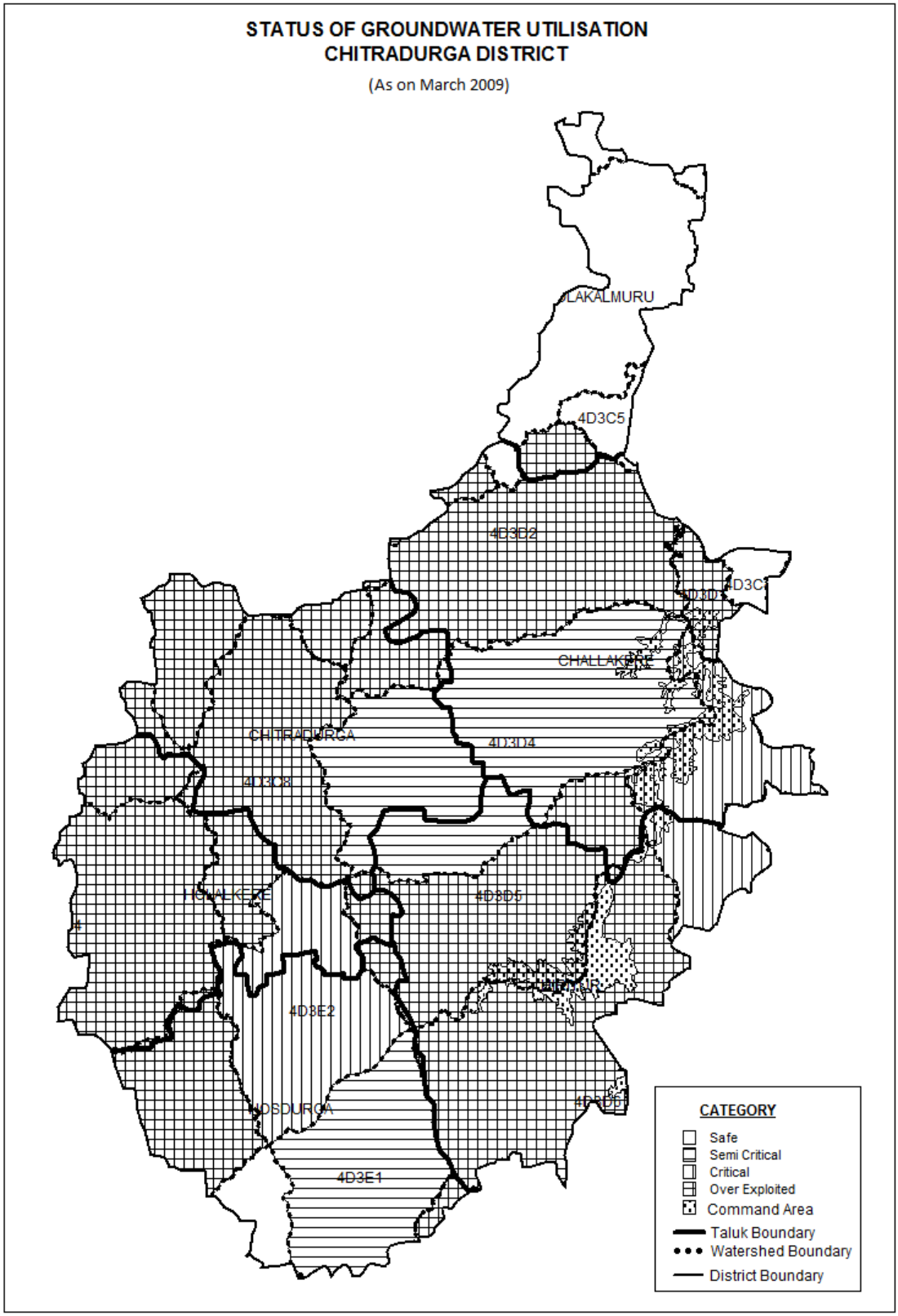
Generally, the ground water development in the district is by dug well, dug –cum-bore well and bore well. The depth borewells used for irrigation is ranging from 60m to 200m with diameter of 148mm to 165mm. The yield of these bore wells varies from >1 to about 10 lps.

The stage of groundwater development in the district is quite high. In Chellakere taluk 32% of the area falls under semi critical, 12% of the area falls under critical and 52% under over exploited category. The stage of development of groundwater for the taluk is 96%. In Chitrdurga taluk, 35% of the area falls under semi critical and 65% under over exploited category. The stage of groundwater development for the taluk is 144%, which is the second highest in the district. In Hiriyur taluk, 7 and 6% of the area falls under semi critical and critical category respectively. 32% of the area falls under over exploited category. The stage of groundwater development for the taluk is 105%. . In Holalkere taluk 13% of the area falls under critical and 87% under over exploited category. The stage of development of groundwater for the taluk is 145%. In Hosadurga taluk, each 30% of the area falls under semi-critical and critical category. 22% of the area is falling under over exploited category. The stage of development of groundwater for the taluk is 95%. In Molakalmuru taluk, 85% of the area falls under safe and 15% under over exploited category. The stage of development groundwater of the taluk is 52%.

Table-2. TALUKWISE GROUND WATER RESOURCES OF CHITRADURGA DISTRICT, KARNATAKA AS ON 31ST MARCH 2009

Taluk	Total Annual GW Recharge	Net Annual GW Availability	Existing gross GW draft for irrigation	Existing gross GW draft for domestic and industrial water supply	Existing gross GW draft for all uses	Allocation for domestic and industrial use for next 25 years	Net GW availability form future irrigation development	Existing stage of GW development	Safe	Semi-critic Critical	Critical	Over-exploited
Units	HAM	HAM	HAM	HAM	HAM	HAM	HAM	%	%	%	%	%
Challakere	9752	8777	7654	747	8401	849	700	96	4	32	12	52
Chitradurga	6214	5593	7590	477	8067	517	261	144		35		65
Hiriyur	12734	11460	11515	528	12043	587	1811	105	5	7	6	82
Holalkere	9978	9320	12906	604	13511	614	6	145			13	87
Hosdurga	9989	8990	7909	621	8530	726	1051	95	10	30	30	30
Molakalmuru	6915	6224	2846	379	3225	480	2946	52	85			15

Fig-9


STATUS OF GROUNDWATER UTILISATION
CHITRADURGA DISTRICT
(As on March 2009)
LAKALMURU
4D3C5
4D3C2
4D3C3
4D3D1
CHALLAKERE
CHITRADURGA
4D3D4
4D3C8
HOLALKERE
4D3D5
4D3E2
HOSDURGA
4D3E1
CATEGORY
Safe
Semi Critical
Critical
Over Exploited
Command Area
Taluk Boundary
Watershed Boundary
District Boundary

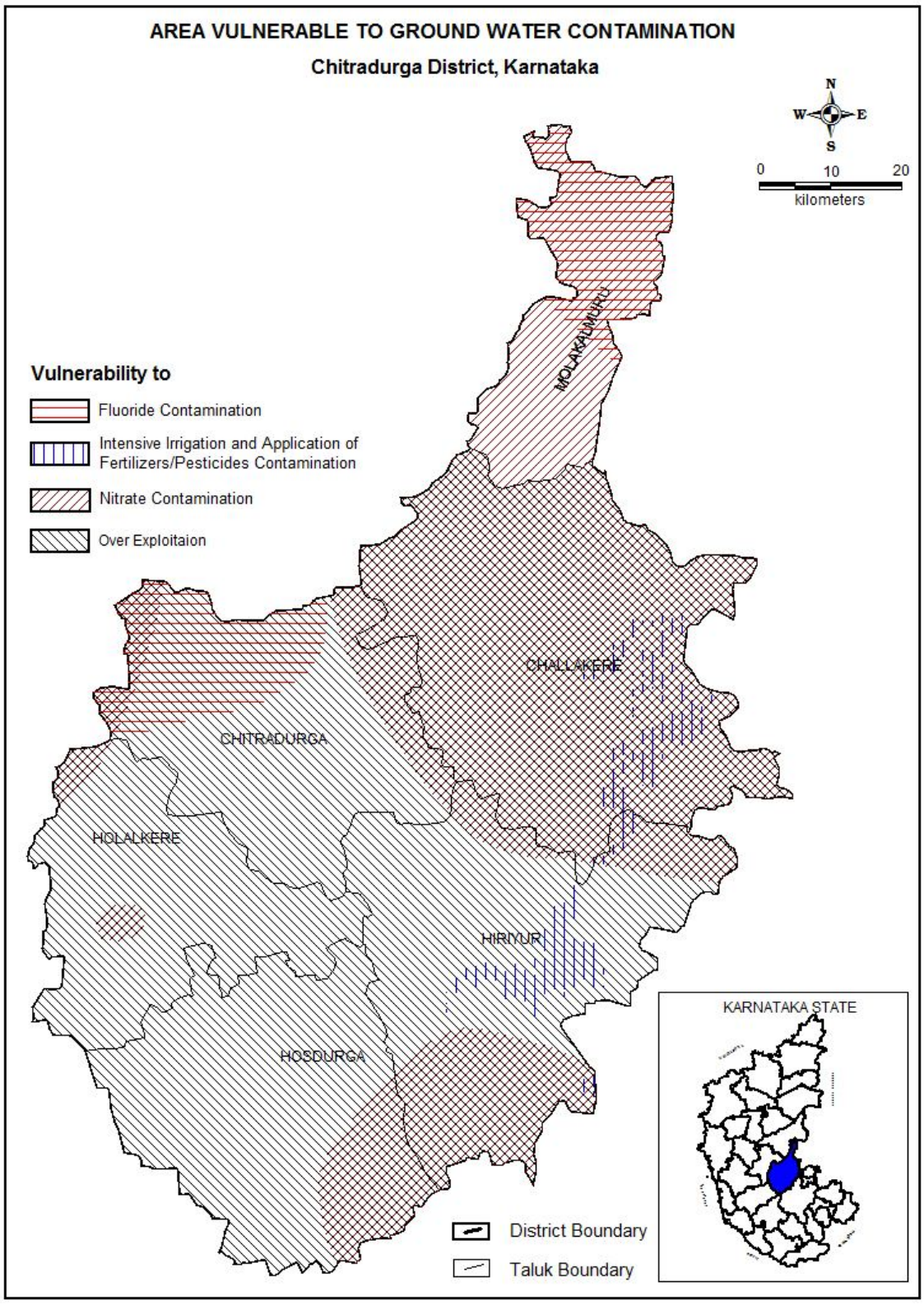
4.5 Groundwater Vulnerability Area

Groundwater being a dynamic resource, getting recharged annually, primarily from the rainfall, is vulnerable to various developmental activities and is prone to deterioration in quality and quantity. The vulnerability is high in certain areas while in other areas it is comparatively stable. Based on it's susceptibility to various stress factors the district wise vulnerability map is prepared on a regional scale considering the following factors viz.

1. Area under high stage of ground water development falling in over exploited (generally with stage of development more than100%) and critical (generally stage of development within 85-100%) category as on March 2009.
2. Area having intensive cultivation/ area falling under canal command, thus prone to pollution from fertilisers/ insecticides or water logging
3. . Area having fluoride above maximum permissible limit of 1.5ppm
4. Area having nitrate above maximum permissible limit of 45ppm. (Even though nitrate is point source pollution due to anthropogenic activity and as such area cannot be demarcated, for the convenience of the user group, area having high incidence of pollution is marked. Within the marked area there may be points devoid of high nitrate and vice-versa.)
5. Industrial cluster as identified by Central Pollution Control Board, prone for pollution from industries.

In some of the districts parts of the area groundwater is vulnerable due to more than one of the above parameters, while in some others the entire district is free from vulnerability.In Chitradurga district, Nitrate contamination is found northern (**Figure 10**) and eastern parts of the taluk. Groundwater over-exploitation is found all the taluks except in Molkalmore taluk. Fluoride contamination is found only in northern and western parts of the taluk where the younger granite is exposed. Pesticide contamination is occurring all along the Vedavathi river course. Anthropogenic activity is the source for the contamination to groundwater. The vulnerable to groundwater system can be controlled by proper management plan.

Fig-10


AREA VULNERABLE TO GROUND WATER CONTAMINATION
Chitradurga District, Karnataka
N
W
E
S
0
10
20
kilometers
Vulnerability to
Fluoride Contamination
Intensive Irrigation and Application of Fertilizers/Pesticides Contamination
Nitrate Contamination
Over Exploitaion
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
KARNATAKA STATE
District Boundary
Taluk Boundary

5.0 GROUND WATER MANAGEMENT STRATEGY

5.1 Ground Water Development

Based on the annual ground water availability for future irrigation use, it is proposed that the ground water development structure viz, dug well, dug cum bore wells and bore wells can be constructed in those areas falling under safe & semi critical category. Location of structure may be decided based on local hydrogeological condition and topography of the area, after scientific surveys.

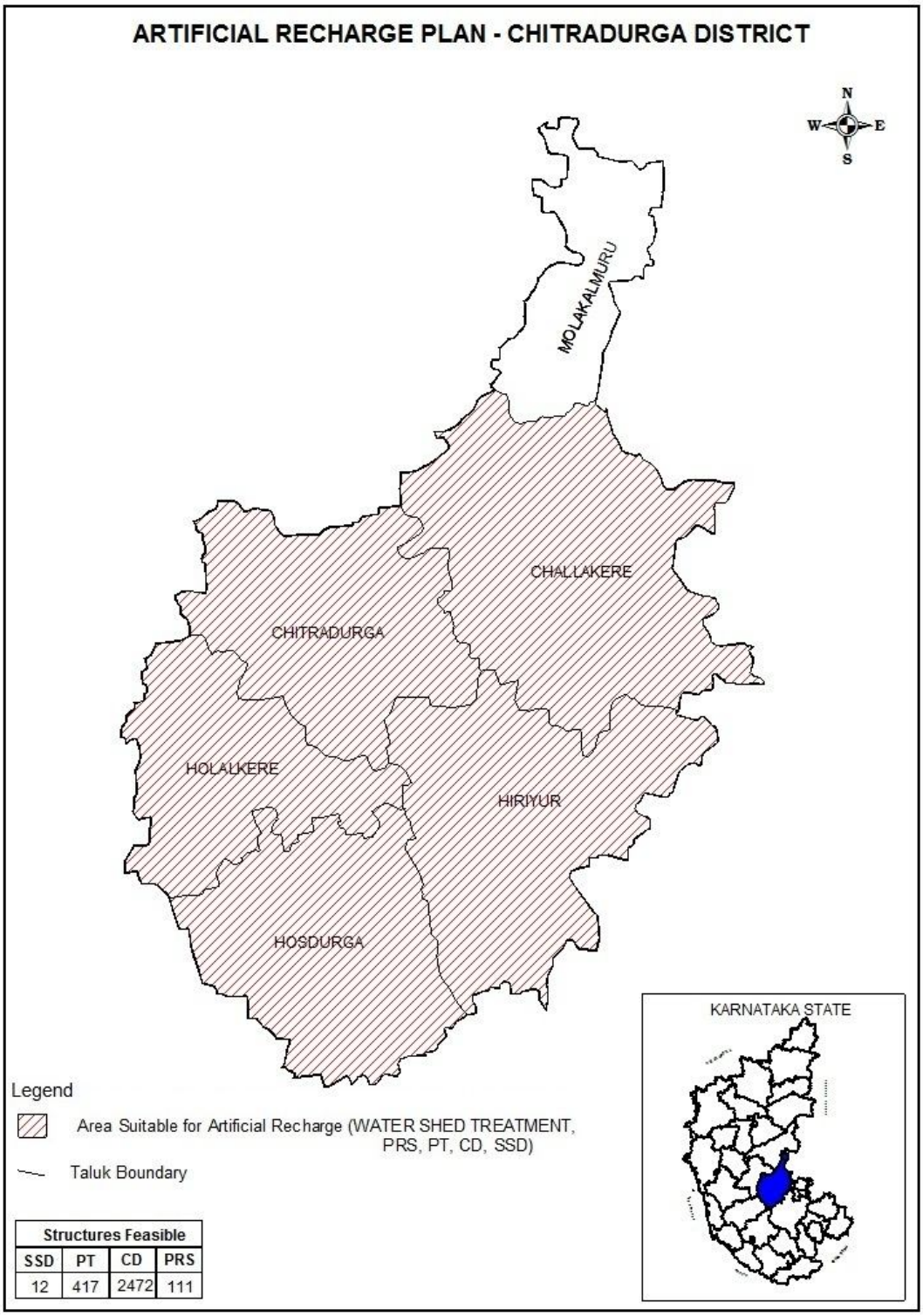
Dug wells are the ideal structures in weathered rocks. The diameter may be 4.5 to 5m and depth between 15 & 20 m. Bore well from the bottom of dug wells may be constructed to tap the weathered and fractured zone where ever feasible based on hydro geological considerations. These may be drilled up to a depth of 40 to 80m with a dia of extension bore wells in the range of 100 to 152 mm.

Bore wells of 152 mm diameter can be constructed from the surface by lowering the casing pipe up to the semi weathered formation and leaving rest of bore well naked. The depth of bore wells in the range of 60 m to 200 m yielding between 2 lps to 10 lps or more can be drilled after scientific investigations for locating the sites

5.2 Water Conservation & Artificial Recharge

As per the resource assessment data, major part of the district is falling under over-exploited and critical category. The stage of groundwater development in the district is more than 100%, which requires immediate intervention by way of conservation and artificial recharge to ground water in order to arrest the declining trend in water level. Artificial recharge to ground water through percolation tank, check dams and nalla bunds are the apt solution to mitigate the water scarcity in plain land of the district **(Figure-11)**. The district is blessed with more than 320 tanks, of which 20 are large with atchkat of more than 200ha, while 146 are having atchkat of 40- 200ha and the rest are having atchkat of 4 to 40ha. Many of these tanks are silted and dried up.

Fig-11


ARTIFICIAL RECHARGE PLAN - CHITRADURGA DISTRICT
N
W
E
S
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
KARNATAKA STATE
Legend
Area Suitable for Artificial Recharge (WATER SHED TREATMENT, PRS, PT, CD, SSD)
Taluk Boundary
Structures Feasible
SSD
PT
CD
PRS
12
417
2472
111

The rejuvenation of these tanks by desilting and construction of additional percolation tanks will help in recharging the phreatic zone. It is the most practical solution to prolong the onset of drought. Subsurface dykes are suitable along river course, wherever the thickness of the alluvium is more.

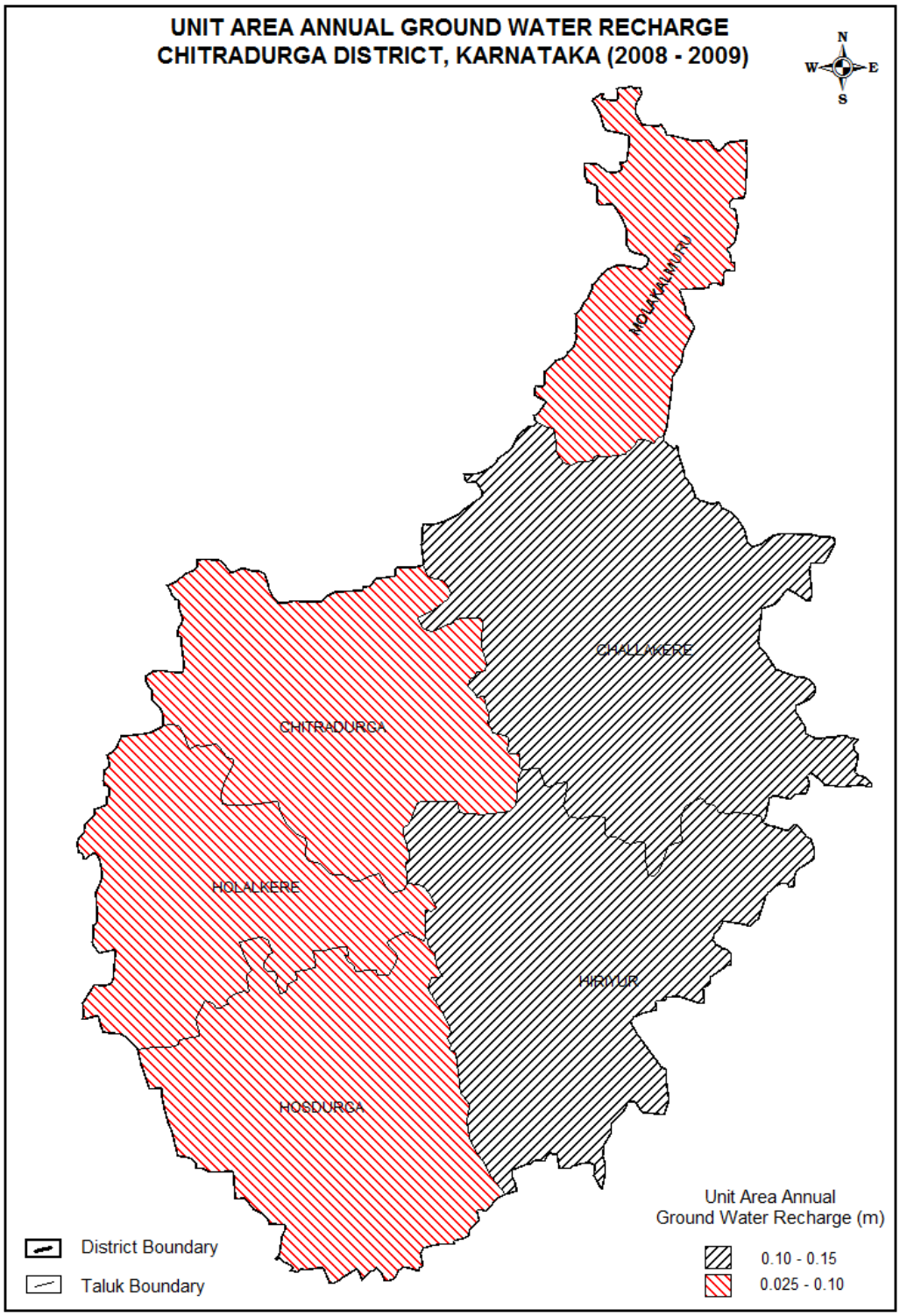
5.2 Unit area annual groundwater recharge

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 period 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 the state of Karnataka, the unit area recharge is grouped into four categories viz. 0.025-0.10m, 0.10-0.15m, 0.15-0.25m and 0.25-0.50m.

In this district the unit area annual recharge is in the range of 0.025 to 0.15. In Molkalmuru, Chitradurga, Hosadurga and Holakere taluks, the unit area annual recharge is in the range of 0.025 to 0.10 **(Figure-12)**. In other two taluks such as Hiriyur and Challakere, the unit area annual recharge is in the range of 0.10 to 0.15.

Fig-12


UNIT AREA ANNUAL GROUND WATER RECHARGE
CHITRADURGA DISTRICT, KARNATAKA (2008 - 2009)
N
W
E
S
MOLAKALMURU
CHALLAKERE
CHITRADURGA
HOLALKERE
HIRIYUR
HOSDURGA
Unit Area Annual
Ground Water Recharge (m)
0.10 - 0.15
0.025 - 0.10
District Boundary
Taluk Boundary

6.0 AWARENESS & TRAINING ACTIVITY

Mass Awareness program was held at Dallara Bhavana, Challakere, Chitradurga district on 30.03.2005. As a part of the programme, a technical session was also arranged. Documentaries on Artificial recharge Schemes and Rain water harvesting with case studies and quality of ground water were shown. Tips on Rain Water Harvesting were given by the members of self-help and user groups, particularly by Sthree Shakti. Working models of Artificial recharge Schemes and Rain Water Harvesting were exhibited. About 300 Representatives from State Govt., educational institutions and farmer community and NGOs participated in the programme.

Water Management Training Programme was held at Zilla Panchayath office, Chitradurga, during 19th and 20th January 2005. The Chief Guest released the training module.

7.0 RECOMMENDATION

The district is drought prone and dug wells dry up in extreme summer. To cope up with the situation, the existing dugwells may be deepened and deep dugwells may be converted into dug-cum-borewells to increase the yield. Artificial recharge to ground water through percolation tank structures are the apt solution to mitigate the water scarcity in the district since more than 320 tanks are available through out the district. The rejuvenation of the existing tanks by desilting and construction of additional percolation tanks will help in recharging the phreatic zone. It is one of the most practical solutions to prolong the onset of drought. Large number of abandoned bore wells/dug well can be used to recharge the aquifer utilizing the surplus surface runoff available during rainy days. Selections of site for bore well should be done only on scientific methods as the yield of bore wells are site specific. Further, bore wells in the district have limited scope as a permanent solution to mitigate the drought situation especially for agriculture purposes.

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