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भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga

Rejuvenation

Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Yadgiri Taluk, Yadgiri District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलोर

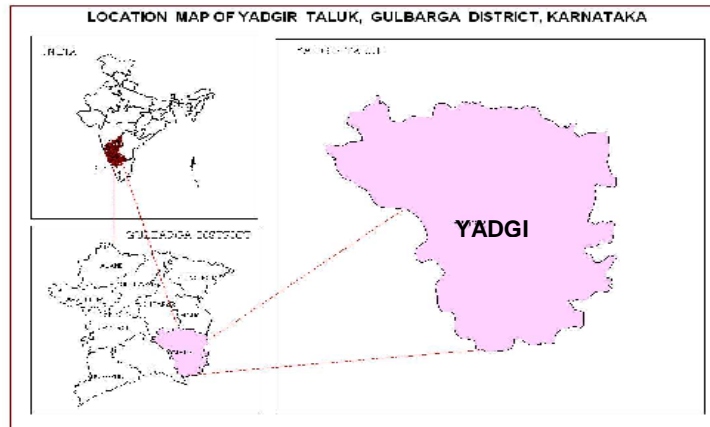
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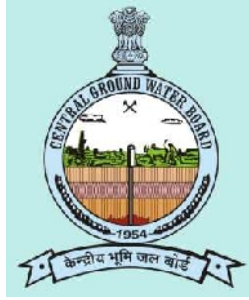
**Government of India
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**YADGIRI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,
YADGIRI DISTRICT, KARNATAKA STATE**



**By
Dr. J. Davithuraj
Scientist 'B'**

**Central Ground Water Board
South Western Region
Bangalore
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**YADGIRI TALUK AQUIFER MAPS AND MANAGEMENT PLANS,
YADGIRI DISTRICT, KARNATAKA STATE**

1. SALIENT INFORMATION

Name of the taluk	: YADGIRI
District	: Yadgiri
State	: Karnataka
Area	: 1,727 sq.km.
Population	: 3,98,359 (2011)
Annual Normal Rainfall	: 850 mm

1.1 Aquifer management study area

Aquifer mapping studies have been carried out in Yadgiri taluk, Yadgiri district of Karnataka, covering an area of 1,727 sq.kms under National Aquifer Mapping Project. Yadgiri taluk of Yadgiri district is located between North latitude 16°28'18.8" and 16°57'13.7" & East longitude 76°58'50.2" and 77°28'31.4", and is covered in parts of Survey of India Toposheet Nos. 56H/1, 56H/2, 56H/5, 56H/6 and 56H/7. Yadgiri taluk is bounded by Chittapur & Sedam taluks of Gulbarga district on North, Telangana state on South & East and Shahpur taluk on Western side. Location map of Yadgiri taluk of Yadgiri district is presented in Fig-1.

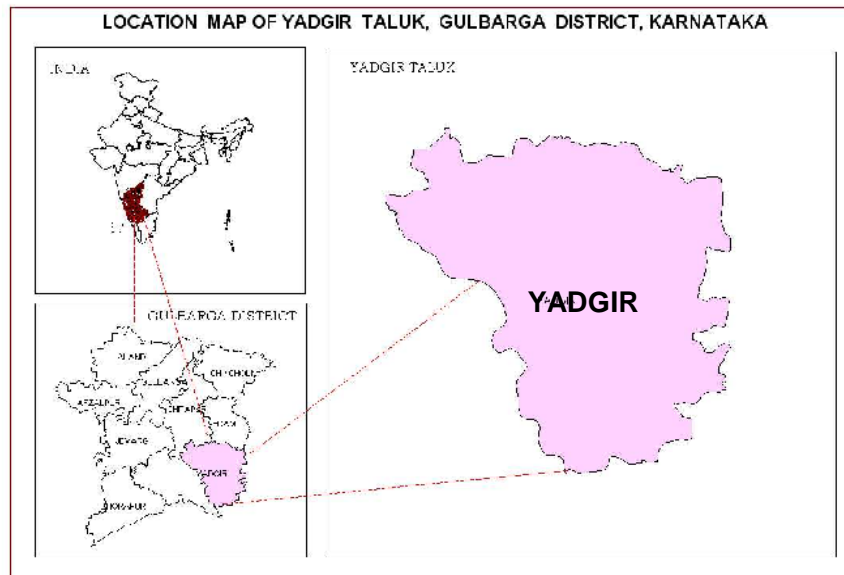


Fig 1: Location Map of Yadgiri taluk, Yadgiri district

Administratively, Yadgiri taluk is divided into 6 Hoblies and three towns namely Yadgiri, Saidapur and Gurumetkal. Yadgiri is the taluk head quarter. There are 152 inhabited and 12 uninhabited villages in Yadgiri taluk.

1.2 Population

According to 2011 census, the population in Yadgiri taluk is 3,98,359, in which 2,98,019 constitute the rural population and 1,00,340 is the urban population, which works out to 75% (rural) and 25% (urban) of the total population of taluk. The taluk has an overall population density of 231 persons per sq.km. The decadal variation in population from 2001-2011 is 22 % in Yadgiri taluk.

1.3 Rainfall

Yadgiri taluk enjoys semi-arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern Eastern Dry agro-climatic zone of Karnataka state and is categorized as drought prone. The normal annual rainfall in Yadgiri taluk for the period 1981 to 2010 is 850 mm. Seasonal rainfall pattern indicates that, major amount of (634 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 75% of the annual normal rainfall, followed by North-East Monsoon season (147 mm) constituting 17% and remaining (70 mm) 8% in Pre-Monsoon season (Table-1).

On Computations were carried out for the 30 year blocks of 1981-2010, the mean monthly rainfall at Yadgiri taluk is ranging between 1 mm during February to 180 mm during September. The coefficient of variation percent for premonsoon, monsoon and post monsoon season is 173, 229 & 188 percent respectively. Annual CV at this station works out to be 309 percent (Table-1).

Table 1: Statistical Analysis of Rainfall Data of Yadgiri Station, (1981 to 2010)

	JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
NRM	6	1	11	16	36	70	117	165	171	180	634	116	24	6	147	850
ST.DEV	17	4	35	17	34	40	88	107	112	101	277	71	37	16	78	275
CV%	32	31	31	94	108	173	133	154	154	179	229	163	64	41	188	309

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Yadgiri taluk. Major Kharif crops are bajra, jowar, tur and paddy. Main crops of Rabi season are jowar, bajra, pulses, groundnut, sunflower and cotton (Table-2). Water intensive crops like sugarcane and paddy are grown in 6% of total crop area. Jowar is grown in 22% and pulses in 28% of total crop area of taluk. Oil seeds is grown in 18% and cotton in 19% of total crop area. Paddy accounts 11% of total crop area.

Table 2: Cropping pattern in Yadgiri taluk 2014-2015

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
	Area under cultivation (Ha)									
2014-2015	9953	10	1031	20734	26299	345	834	16473	95	17675

It is observed that net sown area accounts 48% and area sown more than once is 7% of total geographical area in Yadgiri taluk (Table-3). Area forest and Fallow land cover 14% & 27% of total geographical area respectively. 76% of net area irrigated is from wells & bore wells and 19% from surface water (Table-4).

Table 3: Details of land use in Yadgiri taluk 2014-2015 (Ha)

Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
171073	23881	16768	45618	81710	11846

Source: District at a glance 2014-15, Govt. of Karnataka

Table 4: Irrigation details in Yadgiri taluk

Source of Irrigation	Net area irrigated (Ha.)	% of area
Canals	795	3
Tanks	2870	11
Wells	7632	30
Bore wells	11691	46
Lift Irrigation	1320	5
Other Sources	1183	5
Total	25491	

Source: District at a glance 2014-15, Govt. of Karnataka

1.5 Geomorphology, Physiography & Drainage

The Yadgiri taluk represents undulating terrain with sparsely distributed knolls & tors. The ground elevation ranges about 340 m amsl in the taluk. The regional slope is towards south and southeast (Fig.-2). Krishna and Bhima Rivers drain the Yadgiri taluk. They constitute two major river basins of the taluk (Fig.-3).

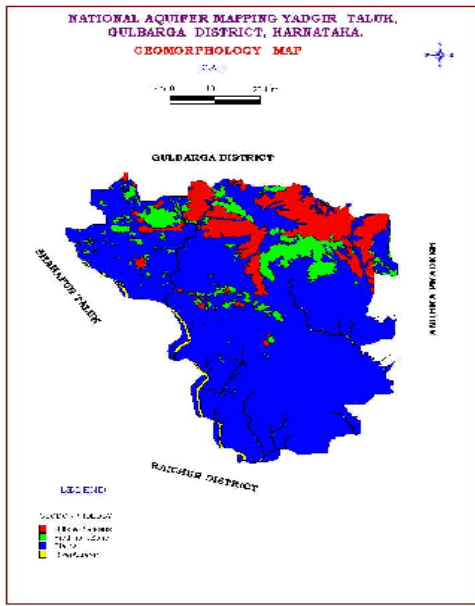


Fig 2: Geomorphology Map

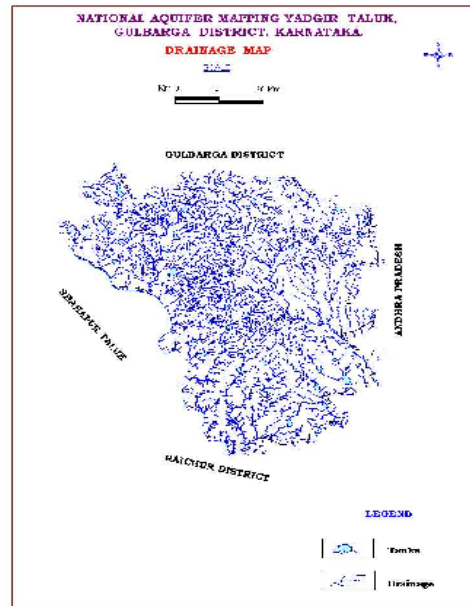


Fig 3: Drainage Map

1.6 Soil

The soil types in the taluk are deep black, medium black soil, shallow soil and lateritic soil. The thickness of deep & medium black soil varies from 0.5 to 3.6 m. Infiltration rate of shallow, medium and deep black soil is moderate to poor. Infiltration rate of medium black soil recorded in the district is 2.5 cm/hr.

1.7 Ground water resource availability and extraction

An aquifer wise total ground water resource up to 200 m depth is given in Table-5 below.

Table 5: Total GW Resources (2013) (Ham)

Taluk	Annual replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic + phreatic in-storage + fractured
Yadgiri	8924	10539	3440	22903

1.8 Existing and future water demands (as per GEC-2013)

- Net ground water availability for future irrigation development : 22.66 MCM
- Domestic (Industrial sector) demand for next 25 years : 5.76 MCM

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

- Pre-monsoon: 7.42 – 12.31 mbgl (Fig.-4)
- Post-monsoon: 1.35 – 13.60 mbgl (Fig.-5)

Aquifer - II

- Pre-monsoon: 5.66 (5.0 - 40.0) mbgl (Fig.-6)
- Post-monsoon: 2.47 – 8.48 mbgl (Fig.-7)

(b) Water level fluctuation

Aquifer-I (Fig.-8)

- Seasonal Fluctuation: Rise ranges 0.92 – 2.02 m;
Fall ranges 4.64 – 6.32 m

Aquifer-II (Fig.-9)

- Seasonal Fluctuation: Rise shows 3.19 m;

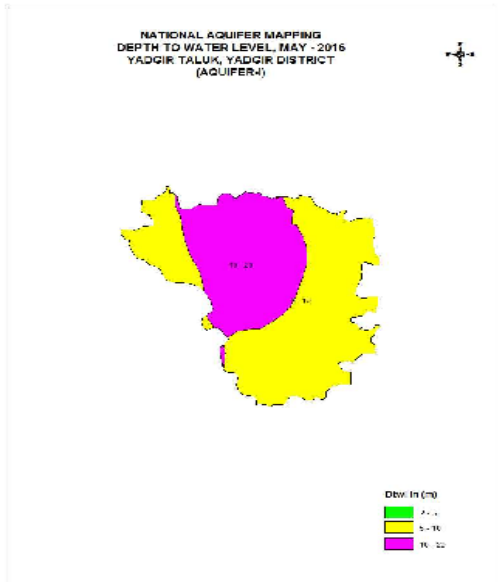


Fig 4: Pre- monsoon Depth to Water Level (Aq-I)

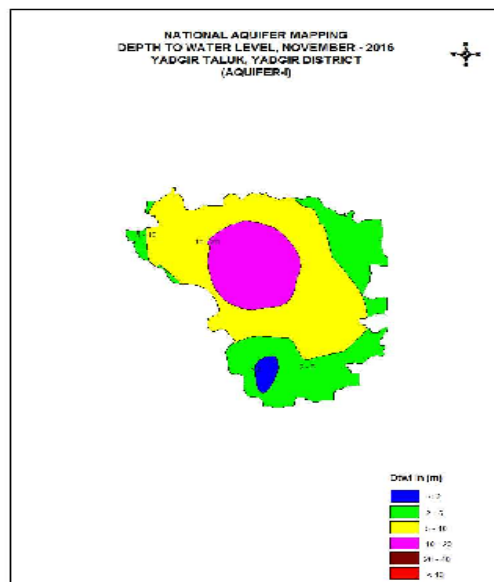


Fig 5: Post-monsoon Depth to Water Level (Aq-I)

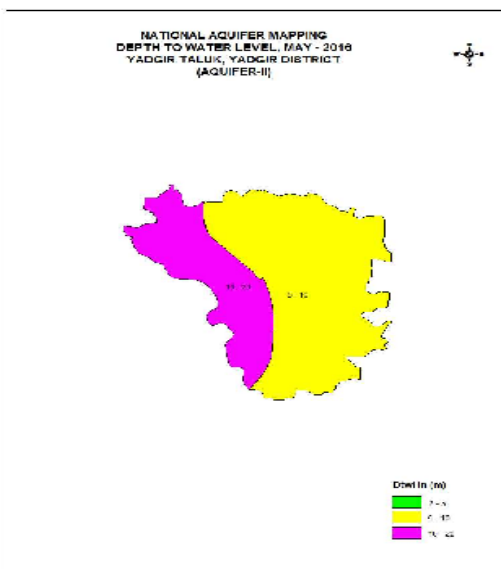


Fig 6: Pre-monsoon Depth to Water Level (Aq-II)

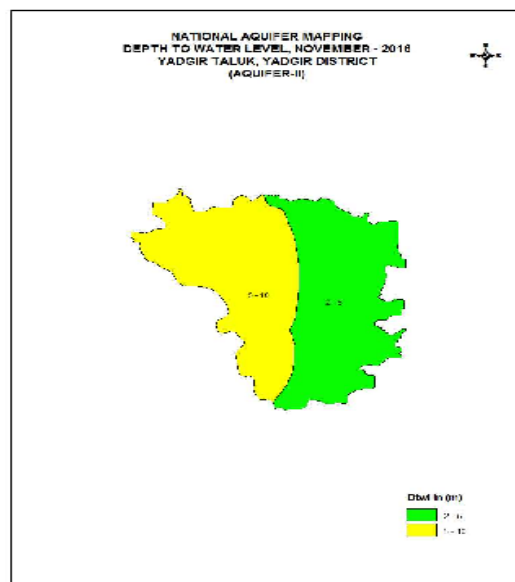


Fig 7: Post-monsoon Depth to Water Level (Aq-II)

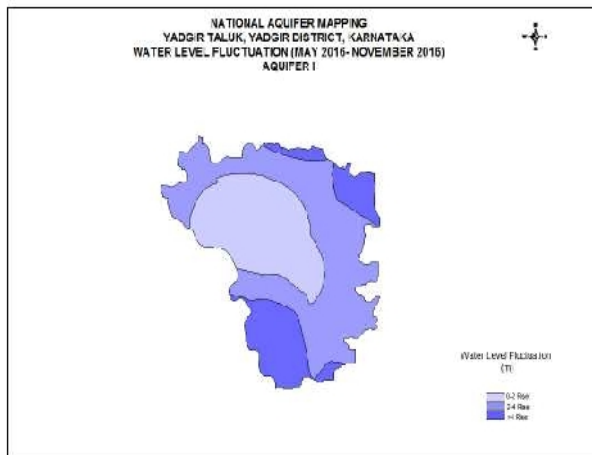


Fig 8: Water Level Fluctuation (Aq-I)

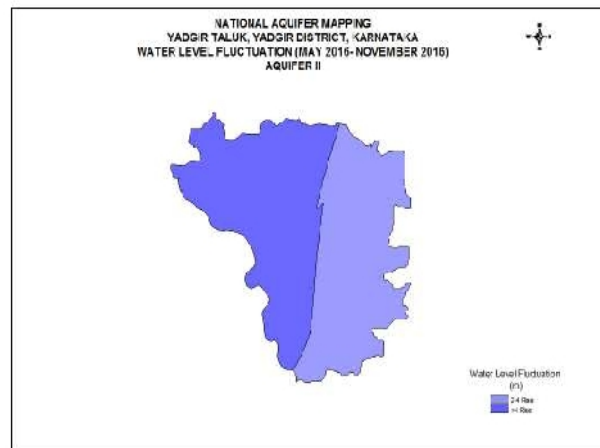


Fig 9: Water Level Fluctuation (Aq-II)

2. AQUIFER DISPOSITION

2.1 Number of aquifers: In Yadgiri taluk, there are mainly two types of aquifer systems;

- i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Gneiss / Granite
- ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Gneiss / Granite

In **Yadgiri taluk**, granitic-gneisses & granite are the main water bearing formations (Fig-10). Ground water occurs within the weathered and fractured granitic-gneisses & granites under water table condition and semi-confined condition. In Yadgiri taluk bore wells were drilled from a minimum depth of 50 mbgl to a maximum of 175 mbgl (Table-6). Thickness of weathered zone (Aquifer-I) ranges from 6.0 mbgl to 29.3 mbgl (Fig-11). Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 15 to 200 mbgl. Yield ranges from 0.01 to 10.5 lps. EC value ranges from 410 to 2000 μ /mhos/cm at 25°C.

The basic characteristics of each aquifer are summarized in Table-7.

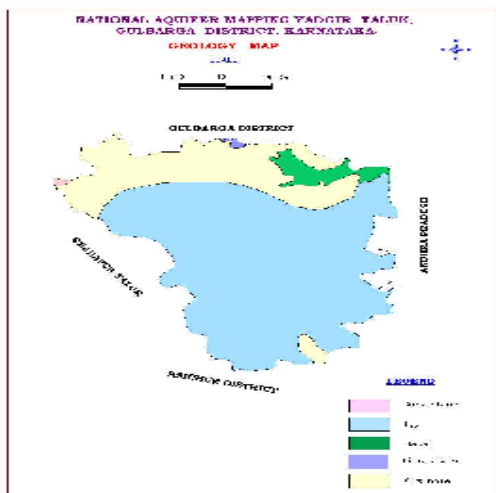


Fig 10: Geology Map

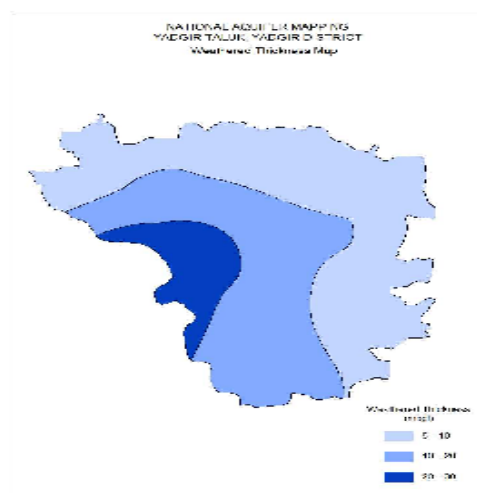


Fig 11: Weathered Thickness Map (Aq-I)

Table 6: Details of Ground Water Exploration

Location	Latitude	Longitude	Depth drilled (mbgl)	Casing (m)	Fracture Zones encountered	SWL (m bgl)	Q (lps)	DD (m)	T (m ² /day)	EC	Cl
Bandehalli	16.7986	77.1417	80	14.5	80	4.80	2.33	7.63	8.94	2000	387
Dharampur	16.8083	77.3833	71.65	6.25	15, 38.1, 54.33	2.60	4.2	6.47	57.8	410	18
Gunjunur	16.7625	77.3667	62.2	12.2	11, 26, 42, 59	4.34	2.33	1.15	330	600	18
Kadachur	16.5125	77.3292	80	13.4	80	4.39	1.63	2.66	198	1100	28
Kadachur	16.5125	77.3292	50	8.5	50	4.02	2	3.69			
Killankera EW	16.6375	77.2514	80	18	8, 28	4.93		-	-	870	11
Mottanhalli EW	16.9375	77.2125	90	6.1							
Nandepalli EW	16.7000	77.3833	58	6	9.5, 15, 27.2	7.42	1.75	1.56	57	500	25
Yargol	16.9014	77.0625	72	12	20, 25, 49, 72	4.62	2.8	3.64	145	1250	181
Yargol	16.9014	77.0625	50	3.5	50	4.73	2.8	1.06	124		
Yadgir EW	16.7615	77.1488	169	18.5		17.02	10.55	6.34			
Yadgir OW	16.7616	77.1483	175	29.3		17.15	9.77	7.57			

Table 7: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Gneiss / Granite	Fractured / Jointed Gneiss / Granite
Thickness range (mbgl)	20	Fractures upto 200 mbgl
Depth range of occurrence of fractures (mbgl)	-	15 - 200 80% between 50 - 200
Range of yield potential (lps)	Poor yield	1 - 5
Specific Yield	2%	0.2%
T (m ² /day)	-	8.9 – 330
Quality Suitability for Irrigation	Suitable	Suitable
Suitability for Domestic purposes	Suitable	Suitable
Remarks	Semi-Critical	Ground water potential fractures, 1 to 3 sets likely up to the depth of 200 m bgl.

3. GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2013)

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	EXISTING STAGE OF GROUND WATER DEVELOPMENT	Category
Yadgiri	8924	6082	467	6549	576	2266	73	SEMI-CRITICAL

(b) Present total Ground Water Resource

Taluk	Annual replenishable GW resources (Ham)	Fresh In-storage GW resources (Ham)		Total availability of GW resource (Ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Yadgiri	8924	10539	3440	22903

(c) Comparison of ground water availability and draft scenario in Yadgiri taluk

Taluk	GW availability (ham)	GW draft (ham)	Stage of GW development, %	GW availability (ham)	GW draft (ham)	Stage of GW development, %	GW availability (ham)	GW draft (ham)	Stage of GW development, %
	2009			2011			2013		
Yadgiri	6969	5795	83	8896	6806	77	8924	6549	73

b. Chemical quality of ground water and contamination

Interpretation from Chemical Analysis results in Yadgiri taluk is mentioned as under:

Electrical Conductivity: In general, EC values range from 650 to 2910 μ /mhos/cm at 25°C which are within the permissible limit in both the aquifers.

Fluoride: Fluoride concentration in ground water is of geogenic origin in areas underlain by younger granites/ gneisses containing minerals like Fluorspar & fluoroapatite. F value ranges between 0.25 – 0.6 mg/l which are also within the permissible limit of 1.5 mg/l.

Nitrate: Nitrate value ranges between 3.4 and 80 mg/l. Nitrate value is greater than the permissible limit of 45 mg/l at Saidapur (62) and Kalabelagundi (80) village of Yadgiri taluk. Nitrate contamination is due to extensive use of fertilizers and sewage problems, hence is anthropogenic in origin.

In general ground water quality in Yadgiri taluk is good for drinking purpose except in some areas as depicted in above illustrated maps, where nitrate & fluoride is found to be greater than the permissible limit as per “Indian Standard Drinking Water Specification 2009”. Ground water samples have also been tested and found suitable for agriculture & irrigation purposes.

4. GROUND WATER RESOURCE ENHANCEMENT

a. Aquifer wise space available for recharge and proposed interventions

Recharge dry phreatic aquifer (Aq-I) in the Yadgiri taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (Table-8). The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge (Fig-12).

Table 8: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	Yadgiri taluk
Non committed monsoon runoff available (MCM)	24.35
Number of Check Dams	150
Number of Percolation Tanks	10
Number of Point Recharge structures	16
Tentative total cost of the project (Rs. in lakhs)	586.98
Excepted recharge (MCM)	13.79
Expected rise in water level (m)	0.44
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

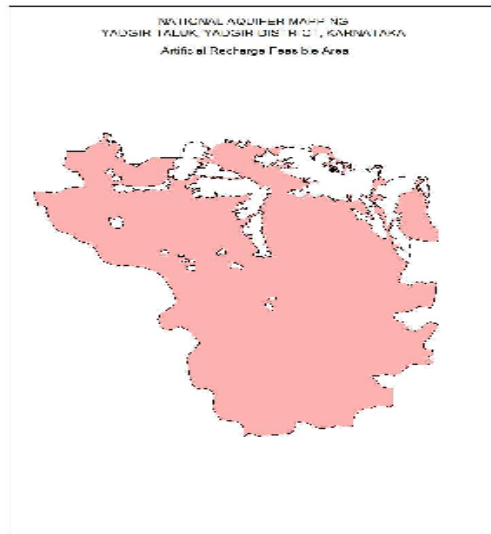


Fig 12: Feasible area for AR Structures

b. Improvement in GW availability due to Recharge, Yadgiri taluk

Taluk	Net annual ground water availability	Existing gross ground water draft for all uses	Existing stage of ground water development	Expected recharge from proposed artificial recharge structures	Additional Potential from Proposed GW Recharge Schemes through Interbasin transfer	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM	HAM		%
Yadgiri	8924	6549	73	1379	7362	17665	37	36

c. Alternate water sources

- **Proposed GW Recharge and Assured Supply of Drinking Water Schemes (Inter basin Transfer):** Inter-basin transfer from Aphinashini & Bedti rivers under Project-4 service canal is proposed in the “Integrated Irrigation Development Schemes” by Shri.G.S.Paramashivaiah, Retd. CE, Irrigation Department and submitted to the Govt. of Karnataka.
- Under this project, it is proposed to fill 1486 Minor Irrigation tanks with 182 TMC of water to 35 taluks of Bagalkote, Bidar, Bijapur, Gulbarga, Yadgiri, Koppal and Raichur districts. 50% recharge is considered from the surface water proposed to fill the tanks

for irrigation, which includes recharge from tanks, canal seepage and return flow from irrigation.

- For Yadgiri taluk, it is calculated that about 7362 Ham can be considered as recharge from above project, if commenced.
- After implementation of Artificial Recharge structures and proposal of GW recharge scheme (inter-basin transfer), the annual ground water availability will increase from 8924 to 17665 ham and the expected improvement in stage of development is 36% from 73% to 37%

5. DEMAND SIDE INTERVENTIONS

a. Advanced irrigation practices

It is observed that dug wells & bore wells are the source for 75% of irrigation in the Yadgiri taluk. Thus, by adopting the below mentioned techniques will contribute in ground water resource enhancement in the long run.

- Efficient irrigation practices like Drip irrigation & Sprinkler needs to be adopted by the farmers in the existing 20541 ha of gross irrigated area by dug wells & bore wells.
- Irrigation draft is 6082 ham.
- Efficient irrigation techniques will contribute in saving ground water by 1490 ham and thus will improve stage of development by 3% from 37% to 34% (Table-9).

b. Change in cropping pattern

Water intensive crops like paddy & sugarcane are grown in 10% of total cropped area by surface water from canals, tanks & lift irrigation sources in the Yadgiri taluk. Hence, change in cropping pattern has not been suggested.

Table 9: Improvement in GW availability due to saving by adopting water use efficiency

Taluk	Cumulative annual ground water availability after implementing AR structures & GW Recharge schemes	Existing gross ground water draft for all uses	Stage of ground water development after implementing AR structures & proposed irrigation development schemes through interbasin transfer	Saving due to adopting WUE measures	Cumulative annual ground water availability	Expected improvement in stage of ground water development after the implementation of the project	Expected improvement in overall stage of ground water development
	HAM	HAM	%	HAM	HAM		%
Yadgiri	17665	6549	37	1824	19490	34	3

c. Regulation and Control

- Yadgiri taluk has been categorized as **Semi-Critical**, since the Stage of ground water development is **73%** (GE March 2013). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control further ground water exploitation in the taluk.
- Ground water recharge component needs to be made mandatory in the non-command area of the taluk for further development of ground water.

d. Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate & fluoride concentration is found in ground water samples require remedial measures viz.
 - Dilution of nitrate rich ground water through artificial recharge & water conservation.
 - Roof top rain water harvesting.

e. Summary

The summary of Management plan of Yadgiri taluk is given in Table-10.

Table 10: Summary of Management plan of Yadgiri taluk

Yadgiri taluk is semi-critical & present stage of GW Development (2013)	73%
Net Annual Ground Water Availability (MCM)	89.24
Existing Gross Ground Water Draft for all uses	65.49
Groundwater development feasibility	22.66
Total GW Resources (Dynamic & Static upto the depth of 200 mbgl) (MCM)	229.03
Expected additional recharge from monsoon surplus runoff (MCM)	13.79
Change in Stage of GW development, %	73 to 63
Expected additional recharge from proposed GW recharge schemes through inter basin transfer (MCM)	73.62
Change in Stage of GW development, %	63 to 37
Expected Saving due to adopting WUE measures (MCM)	18.24
Change in Stage of GW development, %	37 to 34
Excess nitrate & fluoride concentration	<ul style="list-style-type: none"> • Dilution of nitrate rich ground water through artificial recharge & water conservation. • Roof top rain water harvesting.

f. Alternate Management Plan for Yadgiri Taluk

As per GEC-2013, the stage of ground water development of Yadgiri taluk is 73% only and the taluk categorized as 'Semi-Critical'. Instead of recharging ground water from ground water recharge schemes proposed under inter basin and savings from water use efficiency (WUE), it is suggested to create additional irrigation potential from the said sources. The volume of water is calculated from the different sources and summarized in Table-10. According to the table, additional 12283 ha area can be irrigated for Maize crop or 20472 ha area for Jowar. On the basis of cropping pattern of the Yadgiri taluk, additional 22967 ha area can be irrigated for pulses or 19687 ha for sunflower or 11484 ha area can be irrigated for cotton crops (Table-11).

Table 11: Volume of Water proposed / saved and Increase in area of Irrigation

Interventions	Volume of Water proposed by inter basin transfer / savings by WUE		Area can be irrigated using 75% of Irrigation Efficiency for each crop (Ha)				
	(Ham)	(TMC)	Maize	Jowar	Pulses	Sunflower	Cotton
GW Recharge Schemes Proposed (Inter basin Transfer)	7362	2.600	11044	18407	18407	15778	9203
Savings from Water Use Efficiency	1824	0.644	1239	2065	4560	3909	2280
Total	9186	3.244	12283	20472	22967	19687	11484

