



## केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

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**

**Ranebennur Taluk, Haveri District, Karnataka**

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

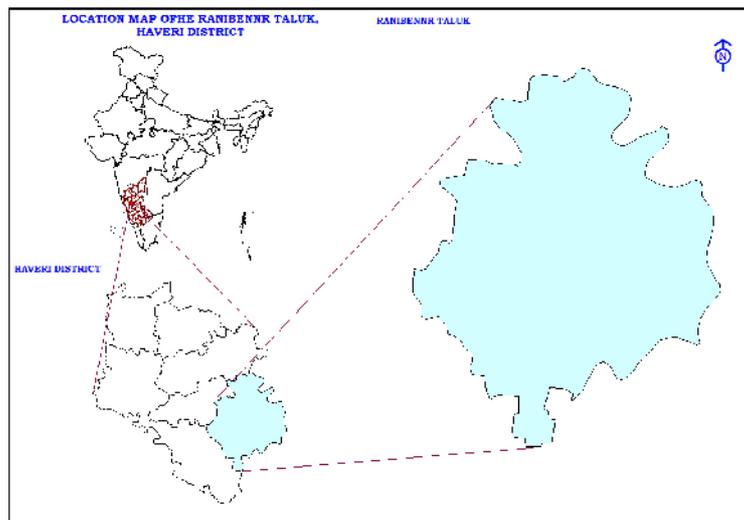
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Ministry of Water Resources,  
River Development & Ganga Rejuvenation  
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**RANEBENNUR TALUK AQUIFER MAPS AND MANAGEMENT PLANS,  
HAVERI DISTRICT,  
KARNATAKA STATE**



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HAVERI DISTRICT, KARNATAKA STATE**

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# AQUIFER MANAGEMENT PLAN OF RANEBENNUR TALUK, HAVERI DISTRICT, KARNATAKA STATE

## 1.0 SALIENT INFORMATION

**Name of the taluk:** RANEBENNUR

**District:** Haveri

**State:** Karnataka

**Area:** 901 sq.km.

**Population:** 3,35,281

**Annual Normal Rainfall:** 630 mm

### 1.1 Aquifer management study area

Aquifer mapping studies have been carried out in Ranebennur taluk, Haveri district of Karnataka, covering an area of 901 sq.kms under National Aquifer Mapping Project. Ranebennur taluk of Haveri district is located between north latitude  $14^{\circ}24'08''$  and  $14^{\circ}47'55''$  & east longitude  $75^{\circ}29'16''$  and  $75^{\circ}49'12''$ , and is covered in parts of Survey of India Toposheet Nos. 57 G/1, G/2, G/5 and G/6. Location map of Ranebennur taluk, Haveri district is presented in Fig.1.

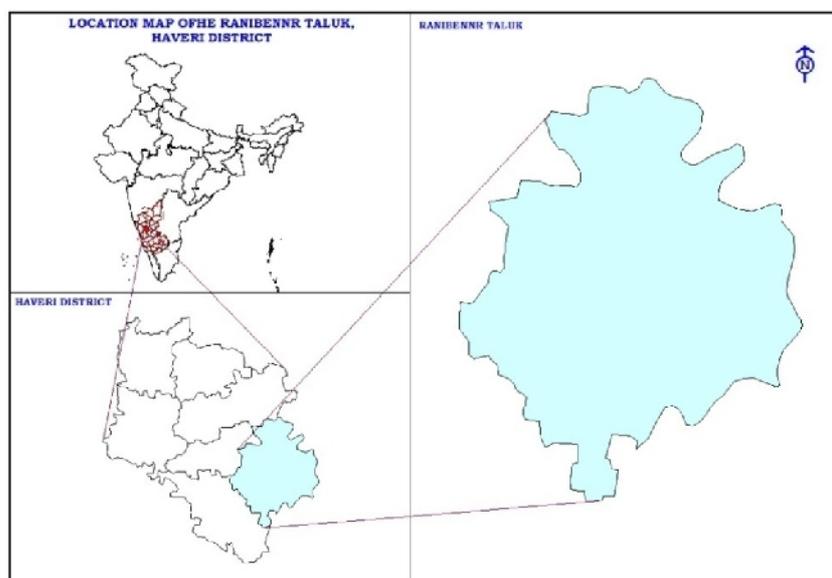


Fig.1: Location map of Ranebennur taluk

### 1.2 Population

According to 2011 census, the population in Ranebennur taluk is 3,35,281, out of which 2,15,549 constitute the rural population and 1,19,732 constitute the urban population. The study area has an overall population density of 373 persons per sq.km. A decadal growth of 9.93% in population of the taluk is recorded during 2001-2011. Projected population of the taluk for the year 2021 is 3,77,208.

### 1.3 Rainfall

Ranebennur taluk enjoys arid climate. Dryness and hot weather prevails in major part of the year. The area falls under Northern Transition agro-climatic zone of Karnataka state and is categorized as drought prone.

The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons: summer from March to May; rainy season or south-west monsoon season from June to September; post-monsoon season covering the months of October and November and dry or winter Season from December to February.

There is one rain gauge station located in Ranebennur taluk (Table-1). The data in respect of this station from the year 1981 to 2010 is analysed and presented in Table-2. The data pertaining to these gauges is of long term nature and are well maintained. It is presumed that they are representative of the taluk and the same is used for analysis. Normal annual rainfall in Ranebennur taluk for the period 1981 to 2010 is 630 mm.

Table 1: Raingauges and its location in Rnebennur taluk

Sl. No.	Station	Latitude	Longitude	Altitude
1	Ranebennur	14°36'	75°39'	589

Computations were carried out for the 30 year blocks of 1981- 2010 on Mean, Standard deviation and coefficient of variation of each month pre-monsoon, monsoon, post-monsoon and annual and are shown in Table-2.

Table 2: Statistical Analysis of Rainfall Data of Rannebennur Taluk, for the Period 1981 to 2010

STATION		JAN	FEB	MAR	APR	MAY	PRE	JUN	JUL	AUG	SEP	SW	OCT	NOV	DEC	NE	Annual
Ranebennur	NRM	0	3	15	38	68	125	91	90	74	93	348	109	41	7	157	630
	STDEV	1	15	31	39	55	74	49	53	33	55	107	69	85	15	107	163
	CV%	32	19	49	100	125	169	187	169	226	169	324	158	48	48	147	386

The mean monthly rainfall at Ranebennur taluk is ranging between Nil during January to 115 mm during October. The Coefficient of Variation (CV) for pre-monsoon, monsoon and post-monsoon season is 169, 324 and 147 percent respectively. Annual CV at this station works out to be 386 percent.

Rainfall data of Ranebennur taluk was analysed for 105 years using IMD method to assess the drought conditions in the taluk. The results of the classification are listed in the Table-3. It is observed that the taluk has experienced alternating no drought to severe drought conditions over the years.

Table 3: Classification of Drought and its periodicity

% Deviation (Di)		>0	0 to -25	-25 to -50	50 to 75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	
		Years				
Taluk	Ranebennur	48	40	15	2	Once in 6 years

Out of 105 years of analysis in Ranebennur taluk, “No Drought” condition in the is experienced in 48 years, “Mild Drought” condition is 40 years and “Moderate Drought” condition experienced in 15 years. Further it is observed that “Severe Drought” condition is experienced in 2 years i.e., during 1965 and 1995 in Ranebennur Taluk. Based on occurrence and frequency of past drought events, It has been observed that occurrence of drought is once in 6 years.

#### 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Ranebennur taluk. Maize is grown in 41.7% of the total crop area followed by cotton, which accounts for 25.5% of the net sown area. Jowar and vegetables cover about 11% of the total crop area each followed by oil seeds which account for 2.8% of total crop area of taluk. Water intensive crops like Paddy (16.36%) and sugarcane (5.04%) are grown in 21.4% of total crop area. (Table-4).

Table 4: Cropping pattern in Ranebennur taluk 2014-2015 (Ha)

Year	Paddy	Maize	Bajra	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
	Area under cultivation (in ha)									
2014-15	10524	26867	0	7003	819	396	6961	1815	3246	16408

It is observed that net sown area accounts 70.88% and area sown more than once is 16.15% of total geographical area in Ranebennur taluk (Table-5). Area not available for cultivation and Fallow land cover 7.83% & 5.90% of total geographical area respectively. 61.9% of the net area irrigated is through bore wells, 0.74% of the net area is irrigated through lift irrigation, and remaining 37.26% of net area irrigated is through other sources (Table-6).

Table-5: Details of land use in Ranebennur taluk, 2014-15 (Ha)

Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Ranebennur	90745	10614	7109	5354	64329	14656

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

Table-6: Irrigation details in Ranebennur taluk (in ha)

Source of Irrigation	Net area irrigated (Ha.)	% of area
Canals	0	0
Tanks	0	0
Wells	0	0
Bore wells	15,408	61.9
Lift Irrigation	186	0.74
Other Sources Such as farm ponds, Check dams, etc	9263	37.26
<b>Total</b>	<b>24,857</b>	

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

### 1.5 Geomorphology, Physiographic and Drainage

Geomorphologically, Ranebennur is generally a gently undulating plain, except for the

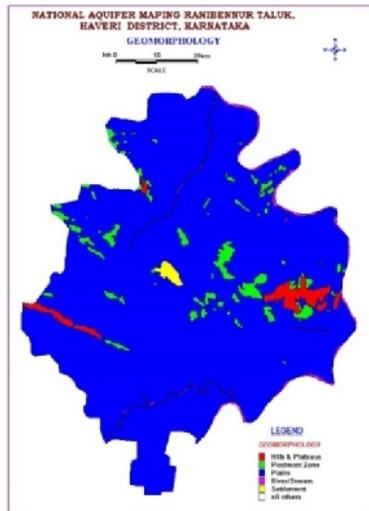


Fig.2: Geomorphology

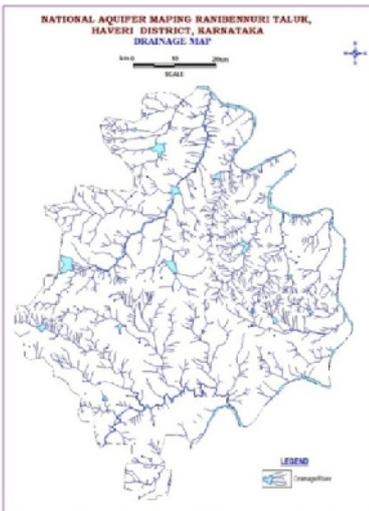


Fig.3: Drainage

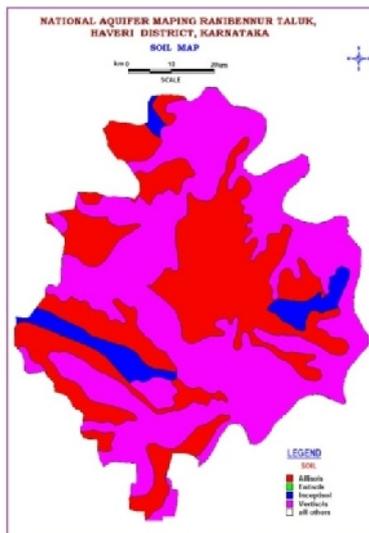


Fig.4: Soils

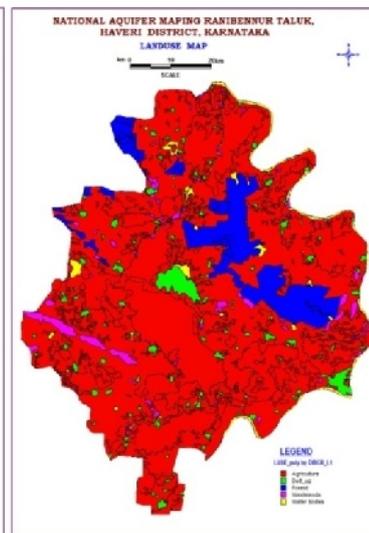


Fig.5: Land use

hilly area on the western most part of the taluk. The general slope in the taluk is in southeast direction (Fig-2). One of Karnataka's most important river - Tungabhadra - flows along the border of Ranibennur taluk in the south. Another river - Kumadvathi - which originates from Madagh Masur Lake flows all the way from Hirekerur taluk & passes inside Ranebennur taluk & finally joins river - Tungabhadra - in Ranebennur Taluk. All the rivers in the district together with their tributaries exhibit dendritic drainage pattern and they form part of Krishna main basin. The drainage map of the taluk is presented as (Fig.3)

## 1.6 Soil

Major part of the Ranebennur taluk is covered by red sandy soil followed by the medium black soil and deep black soil. The red loamy soil and lateritic soil are seen in very small parts of the taluk (Fig.4). Land use in the taluk is given in Fig.5.

## 1.7 Ground water resource availability and extraction

Aquifer wise total ground water resources up to 200 m depth is given in Table-6 below.

Table-6: Total Ground Water Resources (2013) in Ha m

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200 m)	Dynamic + Phreatic in-storage + fractured
Ranebennur	4730	9256	898	14,884

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

- Existing irrigation draft : 4164 Ha m
- Existing Domestic and Industrial sector demand : 529 Ha m
- Limited scope for further irrigation from ground water except few patches where ground water levels are still shallow throughout the year.
- Accordingly, an allocation of 226 Ha m is earmarked for future irrigation and 583 Ha m for industrial and domestic use up to 2025.

## 1.9 Water level behavior

### (a) Depth to water level

#### Aquifer - I

- Pre-monsoon: 1.92 – 8.48 m bgl (Fig.6)
- Post-monsoon: 1.55 – 7.55 m bgl (Fig.7)

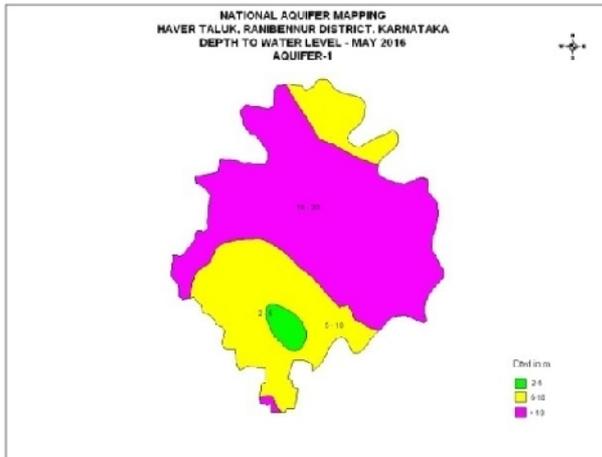


Fig 6: Pre-monsoon DTW (Aq-I)

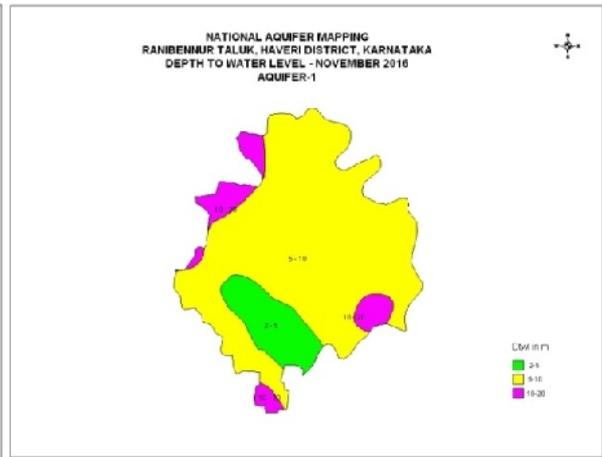


Fig 7: Post-monsoon DTW (Aq-I)

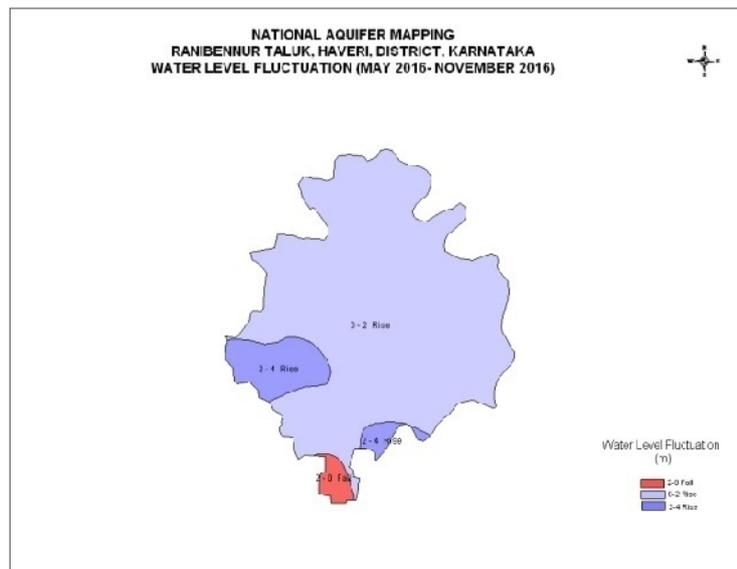


Fig 8: Water Level fluctuation (Aq-I)

**(b) Water level fluctuation**

**Aquifer-I (Fig.8)**

- Seasonal Fluctuation: Rise ranges 0.16 – 0.42 m;  
Fall ranges 0.01 – 1.80 m;

## 2.0 AQUIFER DISPOSITION

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

- i. **Aquifer-I (Phreatic aquifer)** comprising weathered gneiss and granites
- ii. **Aquifer-II (Fractured, multi-aquifer system)** comprising fractured gneiss and granite

Ranebennur taluk, except, for small part occupied by gneisses, exhibits the schistose formations comprised of greywacke, meta-sedimentary, meta-volcanics, green-stones, chlorite sericite-schist, etc. These formations are traversed by various intrusive rocks. Geology map is presented in Fig.9.

The ground water occurs under water-table conditions in the weathered parts Schistose rocks and meta greywacke at shallow depth up to 20 m and generally under semi-confined to confined conditions in the jointed and fractured portions of the above rocks up to about 200 m depth. Twelve exploratory wells were drilled by CGWB under exploratory drilling programme in the depth range of 110-200 m bgl. Yield of the bore wells range from 3.5 to 6 lps. Aquifer disposition, litholog and cross-sections are presented in Fig.10.

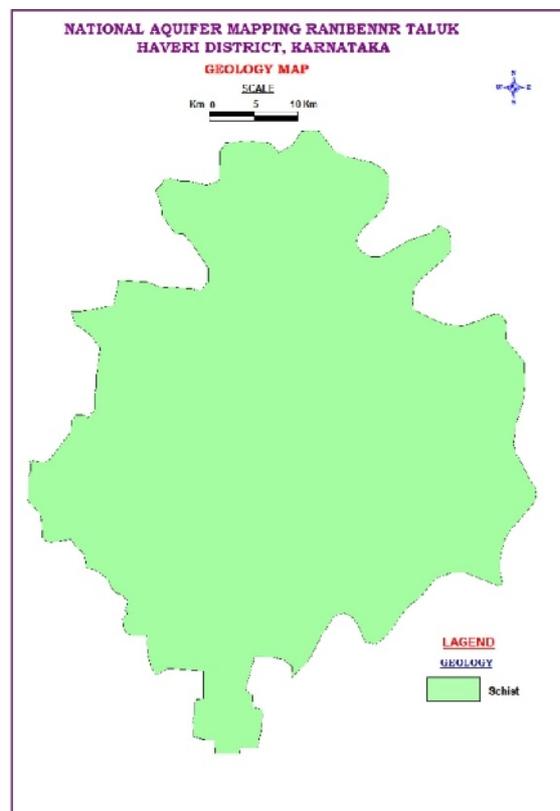
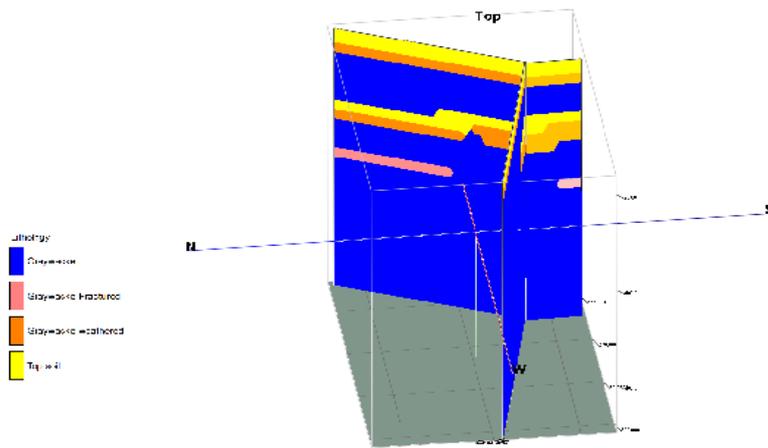
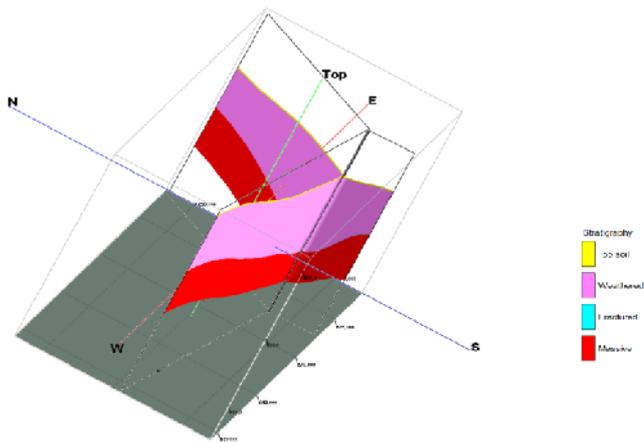


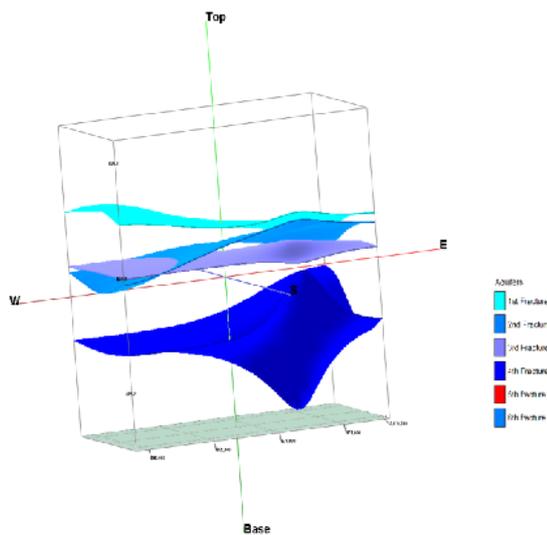
Fig.9: Geology



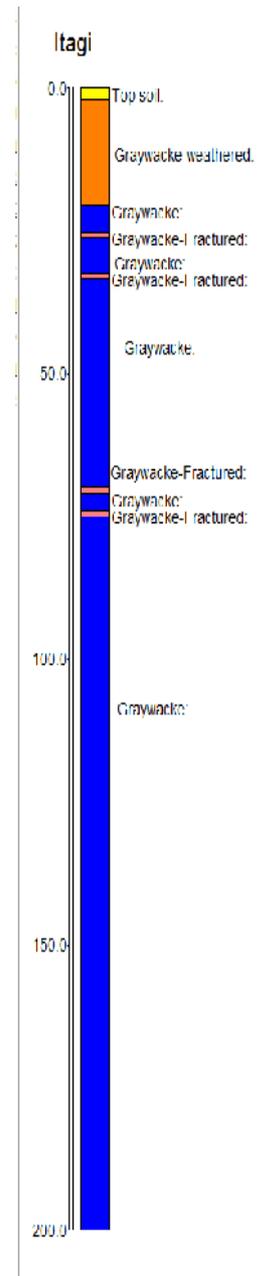
3D Disposition of Litho-units



3D Disposition of Different Stratigraphic layers



3D Disposition of fractured aquifers



Litholog of Exploratory well at Itagi

Fig.10: Aquifer Disposition, Cross - sections and Litholog

### 3.0 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

#### a. Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (GEC 2013) in ha m

Taluk	Net Annual Ground Water Availability (Ha m)	Existing Gross Ground Water Draft for Irrigation (Ha m)	Existing Gross Ground Water Draft For Domestic and Industrial Water Supply (Ha m)	Existing Gross Ground Water Draft for all Uses (Ha m)	Allocation For Domestic and Industrial Use for Next 25 Years (Ha m)	Net Ground Water Availability for Future Irrigation Development (Ha m)	Existing Stage Of Ground Water Development (%)	Category
Ranebennur	4730	4164	529	4692	583	226	99	Critical

(b) Present total Ground Water Resource (GEC-2013) in ha m

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of GW resource
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Ranebennur	4730	9256	898	14884

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

Taluk	GW Availability (Ha m)	GW Draft (H am)	Stage of GW Development	GW Availability (Ha m)	GW Draft (Ha m)	Stage of GW Development	GW Availability (Ha m)	GW Draft (Ha m)	Stage of GW Development
	2009			2011			2013		
	Ranebennur	4650	4288	92	48065	4446	93	4730	4692

## b. Chemical Quality of Ground water and Contamination

### Groundwater Quality (May 2014):

Ground water quality in the taluk is good and potable in general. It is suitable for domestic and irrigation purposes in major parts of the area. All important parameters analysed from the water samples collected from Monitoring stations are within permissible limits. However fluoride above desirable limit have been reported from isolated patches in the taluk ( $>2.2$ ), Nitrate above permissible limit (97-200mg/l) is also reported. Chloride values are above desirable limits almost complete Ranebennur taluk. No in-land salinity is reported in the taluk. Distribution of Fluoride, nitrate, EC and Chloride is presented below in Fig.11 to Fig.14.

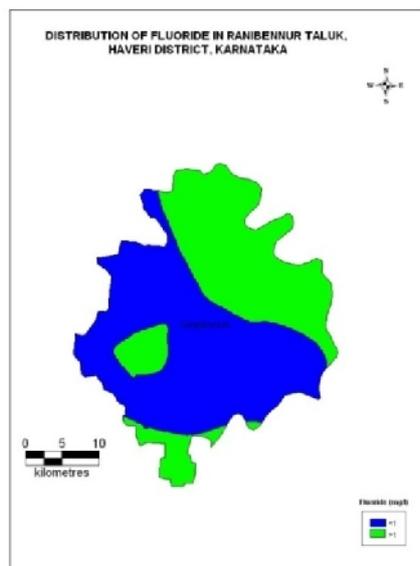


Fig.11 : Fluoride Distribution

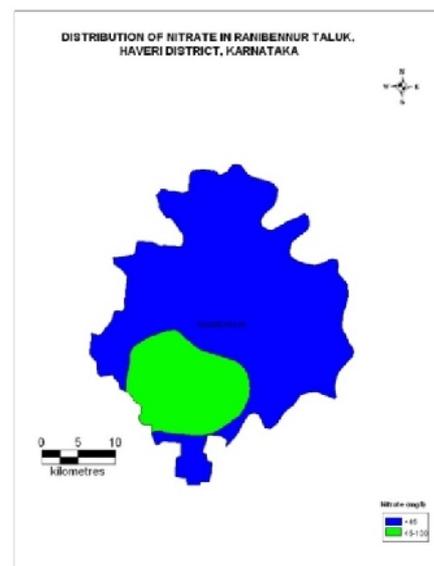


Fig.12 : Nitrate Distribution

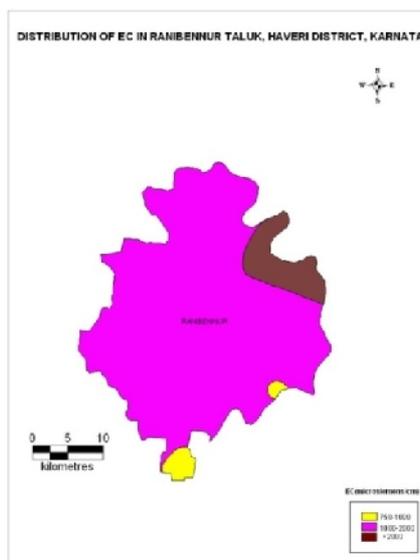


Fig.13: EC Distribution

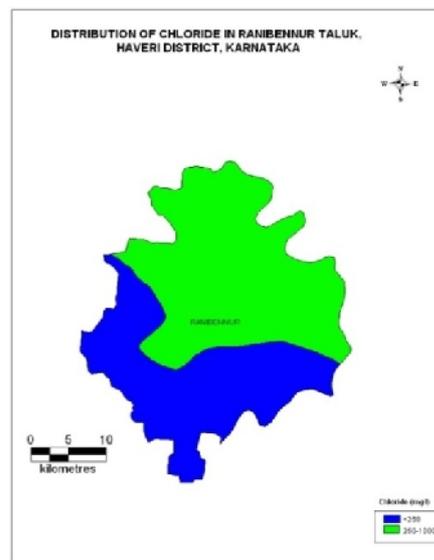


Fig.14: Chloride Distribution

### c. Poor Sustainability

- Entire taluk depends on ground water for irrigation and drinking water requirements
- No major surface water schemes/ are functional in the talk .Surface water supply through canals is meagre.
- Cropping pattern indicates water intensive paddy and sugarcane is being cultivated in considerable part of net irrigated area.
- Rainfall is the only source of recharge
- Deep fractured aquifers are not annually getting recharged and hence, due to prevailing heavy over-draft condition, fractured aquifers are not sustainable.

## 4.0 GROUND WATER RESOURCE ENHANCEMENT

### 4.1 Aquifer wise space available for recharge and proposed interventions

Recharge dry **phreatic aquifer (Aq-I)** in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & point recharge structures (Table-7). 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.15).

NATIONAL AQUIFER MAPPING  
RANIBENNUR TALUK, HAVERI DISTRICT, KARNATAKA  
Artificial Recharge Structures Feasible

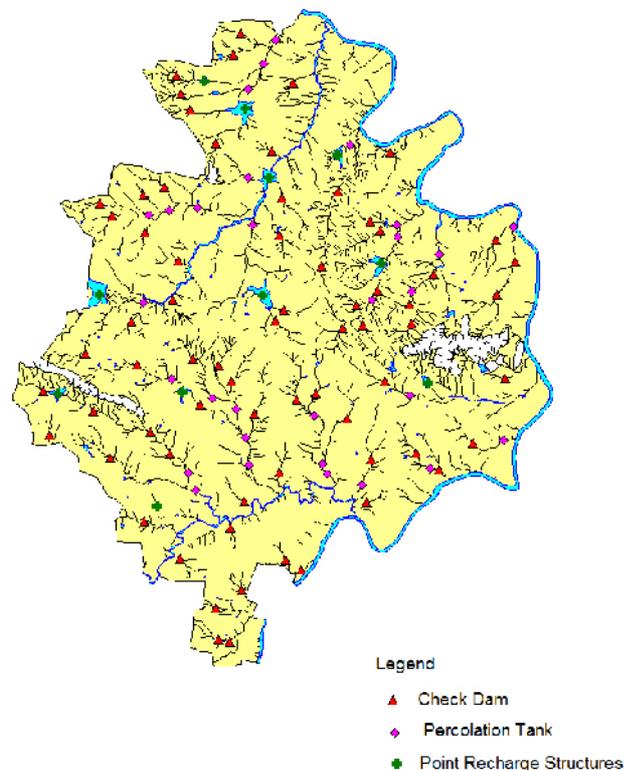


Fig.15: Locations of feasible Artificial Recharge Structures

Table-7: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	Ranebennur taluk
Non committed monsoon runoff available (MCM)	8.5
Number of Check Dams	52
Number of Percolation Tanks	4
Number of Point Recharge structures	6
Tentative total cost of the project (Rs. in lakhs)	204.56
Expected recharge (MCM)	4.807
Expected rise in water level (m)	0.28
Cost Benefit Ratio (Rupees/ cu.m. of water harvested)	4.26

#### 4.2 Improvement in GW availability due to Recharge, Ranebennur 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	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		%
Ranebennur	4730	4692	99	481	5211	9	90

After implementation of Artificial Recharge structures the annual ground water availability will increase from 4730 to 5211 ha m and the expected improvement in stage of development is 9% i.e., from 99% to 90%.

## 5.0 DEMAND SIDE INTERVENTIONS

### 5.1 Advanced irrigation practices

- Efficient irrigation practices like drip irrigation and sprinkler irrigation need to be adopted by the farmers even while using ground water source.
- Since drip irrigation and sprinkler irrigation aims to moisturize only the root zone of the proposed crops, wastage of water, return flow and recharge component from any

applied irrigation is considered to be negligible. Recharge component of sprinkler irrigation is considered as 5% and for drip irrigation, it is considered as nil.

- In case of extending canal irrigation facility extended to the taluk under any scheme, Irrigation efficiency is to be ensured to avoid water logging conditions where depth to water level is < 3 mbgl. In these areas proper drainage facility is to be created to avoid deterioration of soil quality.

## 5.2 Change in cropping pattern:

- Around 10,000 Tube wells are being pumped for irrigating 18845 ha area. Since there are no Surface water schemes operational in the taluk, cultivation of water intensive Paddy (10524 ha) and Sugarcane (3246 ha), which is ground water dependent can be reduced and farmers can opt for more rain-fed millets and water efficient Pulses for agricultural production. Cotton cultivation can be extended to more areas.
- Crops which are suitable for the soil type and traditional cultivation practice of local farmers may be adopted in consultation with agricultural department. Crop water requirement has to be considered before adopting the cropping pattern and preference should be given to light water requirement crops. Water use efficiency should be ensured water productivity in all demand sectors and improved irrigation efficiency.

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

Taluk	Cumulative annual ground water availability after implementing AR Structures & irrigation development schemes	Existing gross ground water draft for all uses	Stage of ground water development after implementing AR structures and Surface water schemes	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		%
Ranebennur	12558	4692	37	1130	13688	03	34

### **5.3 Alternative water sources:**

Proposed Inter-basin transfer from Nethravathi, Kodagau Rivers, Sita River will benefit Ranebennur Taluk, if implemented. Quantum of water proposed for inter-basin transfer is about 6 TMC. 50% of the water from the surface water is proposed to fill the tanks for irrigation.

### **5.4 Regulation and Control:**

Taluk is categorised as "**Critical**" from ground water development point of view. As per the Guidelines of Karnataka Ground Water Authority, the ground water regulation agency in the state Regulations have been imposed on any proposed ground water abstraction by Industrial / Infrastructure / Packaged drinking water agency. Rainwater harvesting and artificial recharge is made mandatory for any ground water withdrawal.

