Draft Report

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

Lingsugur, Raichur District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बैंगलोर

South Western Region,Bengaluru

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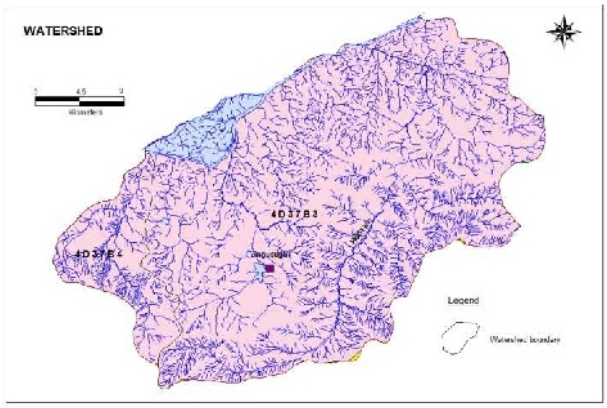
GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES,
RIVER DEVLOPMENT AND GANGA REJUVANATION
CENTRAL GROUND WATER BOARD

LINGSUGUR TALUK AQUIFER MAPS AND MANAGEMENT PLAN, RAICHUR DISTRICT, KARNATAKA



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DECEMBER 2016

LINGASUGUR TALUK AQUIFER MAPS AND MANAGEMENT PLANS,

RAICHUR DISTRICT, KARNATAKA

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AQUIFER MANAGEMENT PLAN OF LINGASUGUR TALUK, RAICHUR DISTRICT, KARNATAKA STATE

1.0 SALIENT INFORMATION

Name of the taluk: **Lingasugur**

District: Raichur, State: Karnataka

Area of the taluk: 1948 sq.km.

Area covered under : 913 sq. km.

Population: 3,21,042 (2011)

Annual Normal Rainfall: 608 mm

1.1 Aquifer management study area

Aquifer mapping studies was carried out in **Lingasugur taluk**, Raichur district of Karnataka, covering an area of **913 sq.kms** under **National Aquifer Mapping Project**. **Lingasugur** taluk of Raichur district is located between North Latitude 16°03'50'' and 16°21'35" and East Longitude between 76° 20' 30" and 76°45'50" and is covered in parts of Survey of India Toposheet Nos. 56D/7, 56D/8, 56D/11, 56D/12 and 56D/15. Lingasugur taluk is bounded on the north and west by Gulbarga District, on the east by Deodurg taluk of Raichur district. Location map of Lingasugur taluk of Raichur District is presented in Fig. 1.

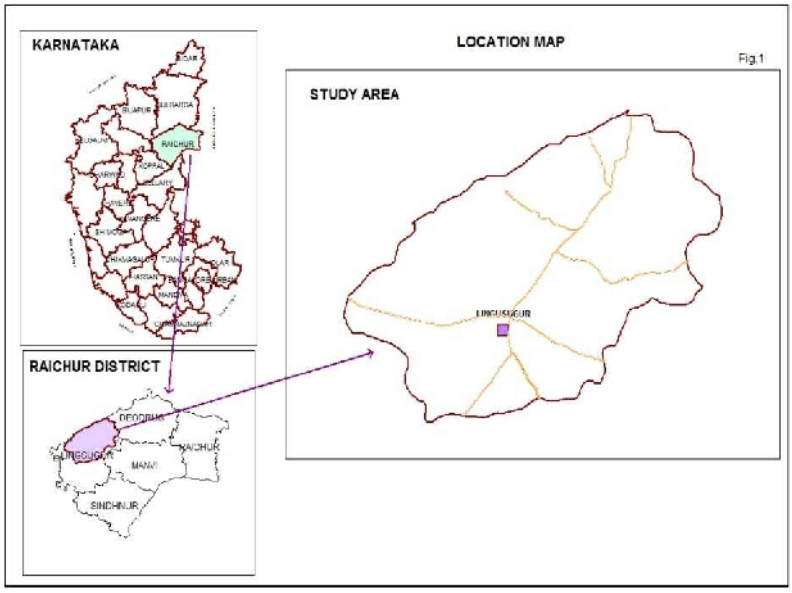

Fig. 1: Location Map of study area
(in Lingasugur taluk, Raichur district)

The district administration of the study area is located at Raichur and Lingasugur is the taluk headquarters. The area has 93 inhabited and 4 uninhabited villages. Lingasugur, the taluk

Headquarters is well connected by roads from different parts of the state. The study area is well connected by means of all weather roads with the district headquarter 'Raichur' and also with other towns in the neighboring districts as well as with the towns in the neighboring State of Andhra Pradesh. The state high way connecting Bangalore to Bidar passes through study area.

1.2 Population

According to 2001 census, the population in Lingsugur taluk was 3,85,699 of which 194363 was male population and 191336 was female population, as shown in the Table1.2. Out of the total population of 3,85,699, rural population was 297743 and 87956 being the urban population, which works out to be 77 % (rural) and 23% (urban) population. The taluk has an overall population density of 165 per sq.km.

1.3 Rainfall

Lingasugur taluk forms part of North Karnataka and experiences semi-arid type of climate characterized by hot summer and low rainfall. Agro-climatically it falls in northeastern dry agro climatic zone. Rainfall analysis for Lingasugur taluk, Raichur district is presented in Table 1 & 2.

Table 1: Rainfall data for Lingasugur taluk, Raichur district.

Lingasugur taluk	Winter (Jan - Feb)	Hot Weather (Mar - May)	South-West Mon (Jun - Sep)	North-East Mon (Oct -Dec)	Annual
Normal	3.1	65.6	374.9	164.5	608.1

Table 2.: Rainfall analysis for Lingasugur taluk, Raichur district**.**

Mean	Std. Dev	Coef. Var	Mean	Std. Dev	Coef. Var	Mean	Std. Dev	Coef. Var	Mean	Std. Dev	Coef. Var
Mar – May			Jun – Sep			Oct – Dec			Annual		
mm	mm	%	mm	mm	%	mm	mm	%	mm	mm	%
65.6	54.2	82.5	374.9	149.6	39.9	164.5	111.0	67.5	608.1	219.1	36.0

The normal Annual rainfall of the area is 608mm. The normal annual number of the rainy days is about 45 days. An analysis of the seasonal variation of rainfall indicates that bulk of the rainfall is received during southwest monsoon period (June to Sept) that is nearly 66.9% of the annual rainfall. The contribution by the northeast monsoon or post monsoon (Oct to Dec) is nearly 24% and the rest 9.1% is the contribution of the dry weather and pre-monsoon period (Jan to May). The statistical analysis of the rainfall for the period 1971-2000 indicate that the

coefficient of variation for the period June 1999 to May 2000 for the Lingasugur is around 36.00% . The southwest monsoon is more reliable as compared to the northeast monsoon.

Rainfall data of Lingsugur taluk, Raichur district has been analysed for 85 years using IMD method. The results of the classification are listed in the Table-3. It is observed that the Lingsugur taluk has experienced alternating no drought to mild (normal) drought conditions over the years.

Table 3: Classification of drought and its recurrence (IMD, 1971)

% Deviation (D_i)		>0	0 to -25	-25 to -50	< -50	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	
		Years				
Taluk	Lingsugur	40	23	18	4	Once in 4 years

The details of the drought assessment are discussed as herein under. Out of 85 years of analysis in Lingsugur taluk, 47% of years showing “No Drought” condition, 27% of years showing “Mild Drought”, 21% of years are “Moderate Drought” and 5% of years showing severe drought conditions.

Severe drought in Lingasugur is observed during the years 1905, 1908, 1912 and 1927. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at Lingsugur station is studied. It has been observed that the frequency of occurrence of drought is once in 4 years.

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Lingasugur taluk. The amount of rainfall and its distribution throughout the season contributes to the cropping pattern in the area. There are two agricultural seasons namely Kharif (June – October) and Rabi season (Mid October – Mid February). Major Kharif crops are paddy, maize, Jowar, tur, and vegetables. Main crops of Rabi season are Paddy, Maize, Jowar, groundnut, and sunflower. Details of cropping pattren and land use in Lingasugur taluk are given in Table 4 & 5 respectively. Irrigation details in study area are shown in Table 6.

Table 4: Details of cropping pattern in Lingasugur taluk (“ha”)

Paddy	Maize	Jowar	Tur dal	Gram	Other pulses	Fruit trees	Vegetables	Groundnut	Sun flower	Wheat
Area under cultivation (in ha)										
6510	31752	417587	5435	1593	33390	345	524	15584	27689	1449

Table 5: Details of land use in Lingasugur taluk (ha)

Item Taluk	Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Net sown area	Area sown more than once
Lingasugur	194010	9077	13013	26805	133781	31869

Source: District at a glance 2009-10, Govt. of Karnataka.

Table 6: Irrigation details in study area (ha)

Net Area Irrigated From	Lingasugur Taluk
Canals	1775
Tanks	102
Wells	2945
Bore wells	7996
Lift Irrigation	751
Other Sources	Nil
Total	36732

Source: District at a glance Govt. of Karnataka 2009-10

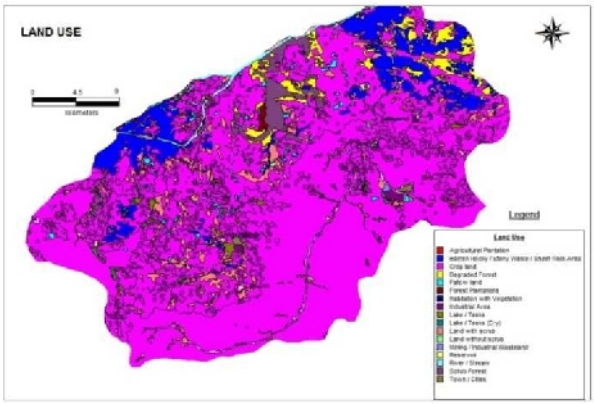

Fig.2: Land use map

1.5 Geomorphology, Physiography & Drainage

Geomorphologically, the study area is covered with hillocks and undulating topography in the north, northeastern and western part and plane with gently slope to the North West in the central part of the area. The southwestern portion of the area is a plain country with scanty vegetation. Geomorphological map of the area is shown in Fig-3.

Physiography in the study area is classified as southern maidan region which is characterized by undulating landscape and flat lands. A series of granitic hills run in the north and north eastern parts of the area. Hillocks and rocky knobs are plenty in the north and north eastern parts of study area. Most of these hillocks are made up of granitic rocks. The general

slope is towards the north and northeast. The topography of the area is rather a flat country in the middle with drainage pattern towards Krishna River in the north and northeast. The general elevation of the area varies from 560m (Southern part) to 400 m (Northern part)

The area is drained by 1st to 4th order streams. The drainage is dendritic with flow direction from south to north. Hire halla and Yalgaldinni/Hatti halla are two major streams and forms the part of Krishna river basin. The drainage network of the study area have indicated that the lower order streams which are confined to the high altitude zones traverse in almost straight and parallel courses followed by subsequent higher order streams with dendritic pattern. The drainage density in the area ranges from 1.32 to 1.62 km/km^2. The drainage network of the area is shown in the Fig-4.

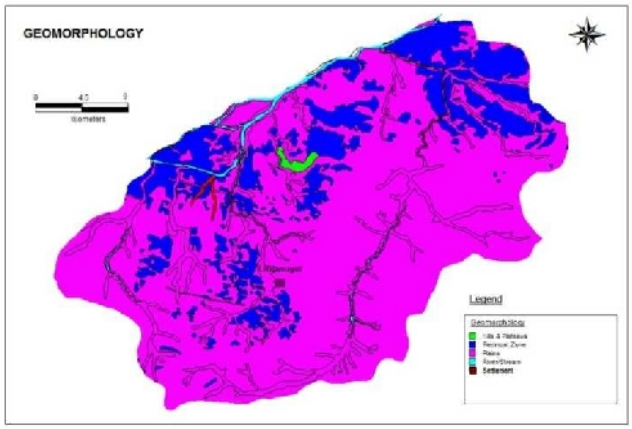

Fig.3: Geomorphology

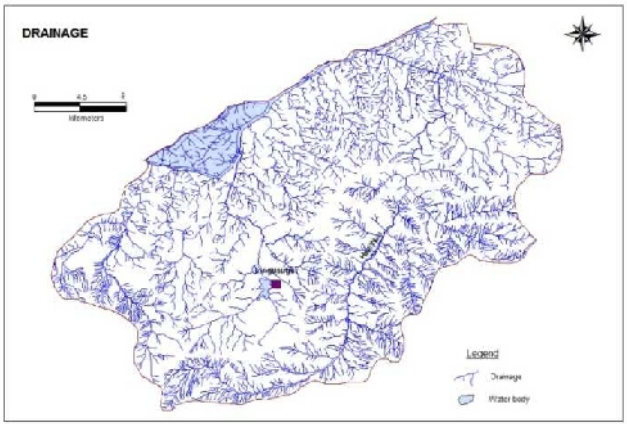

Fig. 4: Drainage map

1.6 Soil

Five classes are clayey, clayey mixed, clayey skeletal, Loamy skeletal and Rocky land. Clayey soil in western side of study area, loamy skeletal soil in the eastern part, clayey mixed along the major drainage flowing in the taluk.

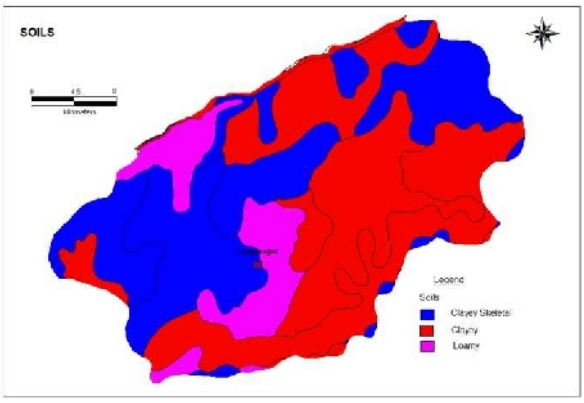

Fig. 5: Soil map

1.7 Ground water resource availability and extraction (Aquiferwise up to 200 m depth)

Total GE Resources (2009), (Ha m)

Taluk	Annual replenishable GE resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200 m)	Dynamic + phreatic in-storage + fractured
Lingasugur	7158	14199	3801	25158

1.8 Existing and future water demands

- For further Irrigation from ground water: 1361.99 HAM.
- Domestic (Industrial sector) demand: 772.02 HAM (GWRE-2011)

1.9 Water level behavior

(a) Depth to water level

Aquifer - I

- Pre-monsoon: 0.86 to14.52 mbgl

- Post-monsoon: 0.79 to 14.08 mbgl

Aquifer - II

- Pre-monsoon: 2.12-22.65 mbgl

- Post-monsoon: 1.47-25.36 mbgl

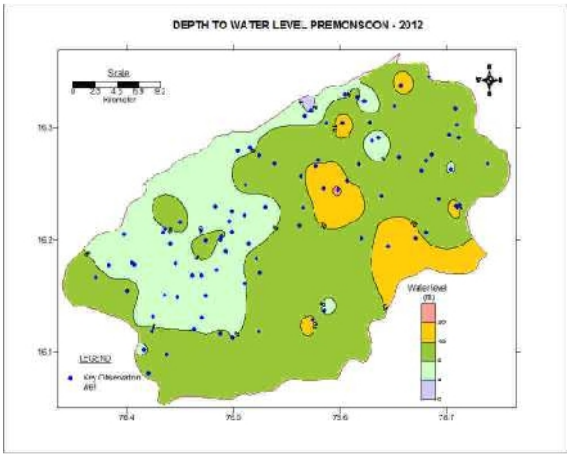

Fig 6: DTW map pre-monsoon

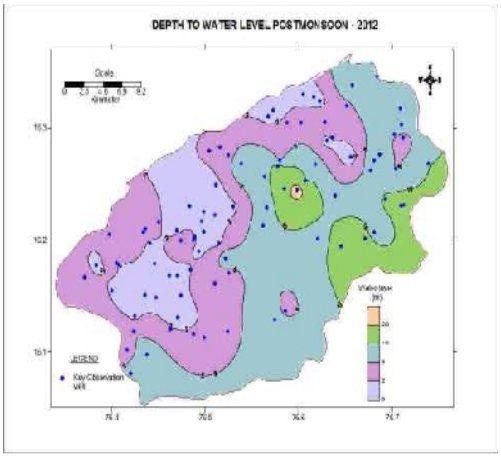

Fig 7: DTW map post-monsoon

(b) Water level fluctuation

Aquifer-I

- Seasonal Fluctuation: Rise ranges between <1 to 6 m;

In majority of the area water level fluctuation has rising trend except north eastern part of the area. The area around Yerdoni, Devabhupur and Amareshwara also shows falling trend.

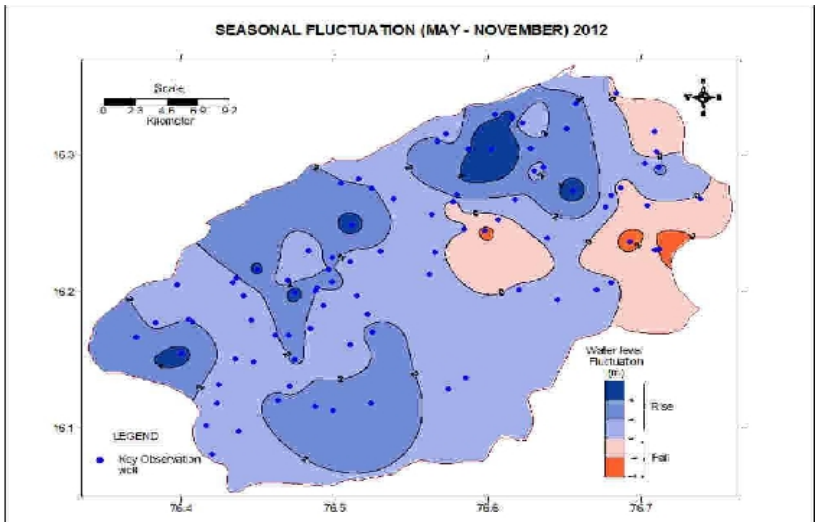

Fig 8: Water level fluctuation map (Aq – I)

2.0 AQUIFER DISPOSITION

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

i. **Aquifer-I (Phreatic aquifer)** comprising Weathered Gneiss / Granite / Schist

ii. **Aquifer-II, (Fractured multi-aquifer system)** comprising Fractured Gneiss / Granite / Schist**.** Geology map of the area is given in figure 9.

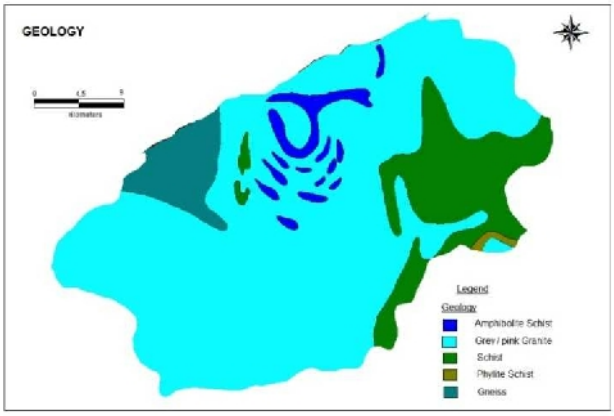

Fig 9: Geology map of Lingasugur taluk

2.2 3 D aquifer disposition and basic characteristics of each aquifer

To understand the aquifer disposition and its potentiality, well inventory was carried out in the area. The depth of lining/casing gives information on depth of weathering and in most the villages it is about 7 m bgl. The depth of weathering is more than 10 m bgl in the area around Kadoni, Tavag, Rodal banda and Yelgatti.In majority of the area depth to water ranges between 5 and 10 m bgl during both pre and post- monsoon periods.

A single well strip log gives vertical information of lithology consisting of soils, highly weathered, weathered, massive formations with fractures and massive formation at a particular site.

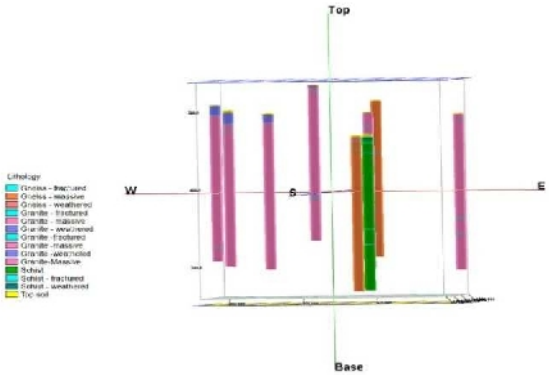

Fig. 10: Single well strip log **– Rockworks output**

3.0 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

3.1 Aquifer wise resource availability and extraction

(a) Present Dynamic Ground Water Resource (2011)

Taluk	Net annual GW availability (in ham)	Total draft for all uses (in ham)	Stage of GW development, %	Category
Lingasugur	6729.87	5737.07	85	**Semi-Critical**

(b) Present total Ground Water Resource (in ham)

Taluk	Annual replenishable GW resources (in ham)	Fresh In-storage GW resources (in ham)		Total availability of GW resource (in ham)
		Phreatic	Fractured	Dynamic + phreatic in-storage + fractured in-storage
Lingasugur	7158	14199	3801	25158

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

Taluk	GW availability (in ham)	GW draft (in ham)	Net Balance	Stage of GW development	GW availability (in ham)	GW draft (in ham)	Net Balance	Stage of GW development
	2009				2011			
Lingasugur	7158	6613	542	**92**	6729.87	5737.07	992.80	**85**

3.2 Chemical quality of ground water and contamination

During Aquifer Mapping Studies in Lingasugur taluk, ground water samples have been collected from 61 dug wells (Aquifer-I) and from 59 bore wells (Aquifer-II) during pre-monsoon. The ground water samples were analysed for major chemical constituents at chemical laboratory at CGWB, SWR, Bangalore and analytical results are given in Appendix-III. The analytical data have been considered to assess the chemical quality of ground water and its suitability for drinking, domestic and irrigational purposes.

Electrical Conductivity: According to Wilcox classification, 6% of ground water samples from Aquifer-I and 5% samples from Aquifer-II have EC value more than 2250 μmhos/cm. 51% of ground water samples from Aquifer-I and 49% samples from Aquifer-II have EC value between 750- 2250 μmhos/cm and falls in medium salinity to high salinity category.

Isocone map of Aquifer-I (Fig-10) depicts that west central part of the area covering about 35% of the area and in one isolated pocket around Paidoddi having EC value between 250 and 750µmhos/cm. About 50% of the area in the eastern and extreme western part having EC value 750 to 2250 µmhos/cm and falls under medium to high salinity category and the water is safe only with permeable soil and moderate leaching practices. There are two isolated pockets, one in central part of the area around Hatti and Sarjapur and another area around Anehosur to the extreme south western part of the study area having EC value between 2250 and 4000 µmhos/cm and is not suitable for agricultural practices. The area around Yerdoni is showing the EC value more than 4000 µmhos/cm.

Isocone map of Aquifer-II (Fig-11) shows that west central part of the area covering about 50% of the area and in isolated pocket around Nandihal and around Goudur, Manchal doddi and Bandebhavi having EC value between 250 and 750 µmhos/cm. About 40% of the area in the eastern and extreme western and south western part of the area having EC value 750 to 2250µmhos/cm and falls under medium to high salinity category. The area around Hatti, Kuppigadde and Sarjapur having EC value between 2250 and 4000 µmhos/cm and is not suitable for agricultural practices.

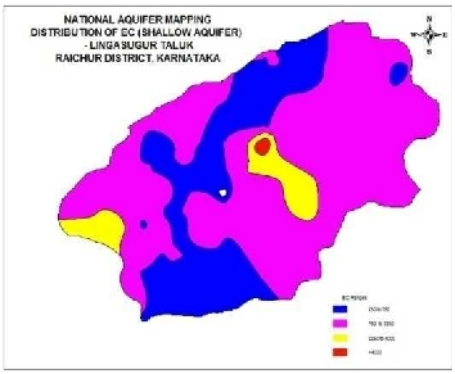

Fig 11: EC map (Aq-I)

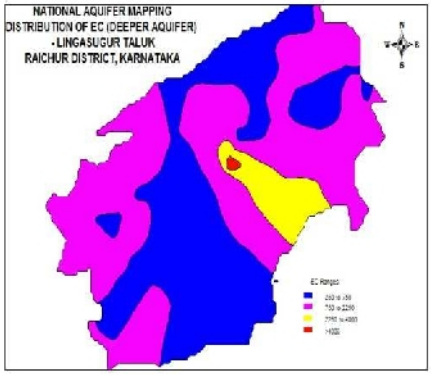

Fig 12: EC map (Aq-II)

Fluoride: The concentration of fluoride in ground water of the area ranges from 0.33 ppm to 3.9 ppm (Aquifer-I) and from 0.29 ppm to 4.8 ppm (Aquifer-II). 26% of samples from Aquifer-I and 42% of samples from Aquifer-II are showing fluoride concentration more than its permissible limit and are not suitable for drinking purpose. Remaining samples are within the permissible limit. Fluoride concentration in ground water is of geogenic origin in areas underlain by younger granites/ gneisses containing minerals like Flurospar and fluroapatite.

Nitrate: The concentration of nitrate in ground water of the area ranges from 3 mg/l to 230 mg/l(Aquifer-I) and from 4mg/l to 160mg/l(Aquifer-II). The ground water samples have been examined as per the standards prescribed by BIS (IS-10500-1991). 34% of samples from both the aquifers are behind permissible limit and are not suitable for drinking purpose. Remaining 66% of the samples are within permissible limit and are suitable for drinking purpose.

Arsenic: In order to know the arsenic concentration in ground water, ground water samples have been collected from 25 dug wells (Aquifer-I) and from 27 bore wells (Aquifer-II) during March-2013. 12 samples having arsenic concentration more than permissible limit. Distribution of arsenic concentration in groundwater is shown in Fig 12 and Fig 13.

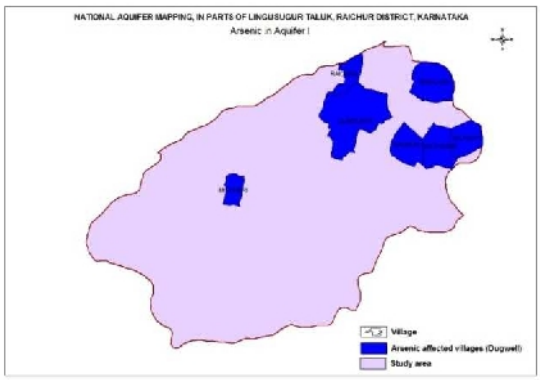

Fig 13: Arsenic in Aq-I

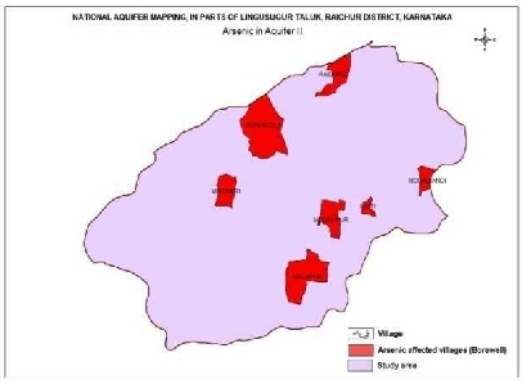

Fig 14: Arsenic in Aq-II

Magnesium: The concentration of magnesium in groundwater of the area ranges from 5 to 290 ppm and from 10 to 140 ppm for Aquifer-I Aquifer-II respectively. The quality of groundwater is examined as per the standards prescribed by WHO and it is found that most of the samples are within permissible limits except few samples.

In general, ground water quality in the area is good for drinking purpose except in some areas as depicted in above illustrated maps, where Arsenic and EC is found to be higher than the permissible limit as per “Indian Standard Drinking Water Specification 2012”. The quality of ground water in the area is generally potable except area around Sarjapur, Hatti, Madinapur and Yardoni.

4.0 GROUND WATER RESOURCE ENHANCEMENT

Artificial Recgarge measures

Number of Artificial Recharge Structures to be constructed in parts of Lingasugur Taluk, Raichur District						
Structures	No	Unit Cost (Rs Lakhs)	Estimated Cost (Lakhs)	Annual Storage Capacity	Volume of water likely to recharged	Additional Irrigation Potential Likely to be created
Check Dam	11	3.0	33.0	1.342	0.67	124
Percolation Tank	1	7.5	7.5	0.453	0.34	
Point Recharge Structure	1	2.0	2.0	0.018	0.02	
TOTAL	13		42.5	1.813	1.17	

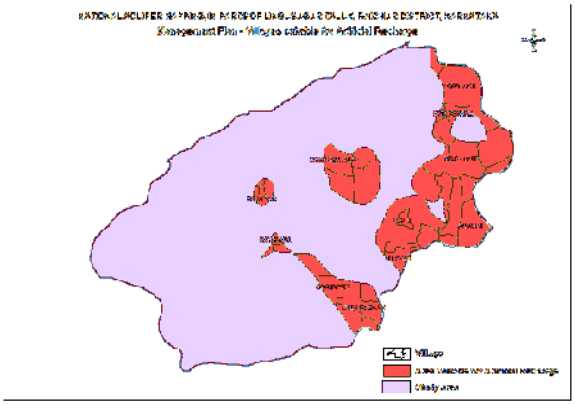

Fig 15: Area feasible for Artificial recharge

5.0 DEMAND SIDE INTERVENTIONS

5.1 Advanced irrigation practices

Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers. Efficient irrigation techniques will contribute in saving ground water and thus will reduce the irrigation draft. By adopting the above said techniques will contribute in ground water resource enhancement in the long run.

5.2 Change in cropping pattern

Water intensive crops like paddy is grown in the parts of canal command area. In the rest of the area water intensive crops are not grown. Hence there is no need of change in the cropping pattern.

5.3 Regulation and Control

Lingasugur taluk has been categorized as **semi-critical**, since the Stage of ground water development has reached **85%** (GE March 2011). Hence, ground water recharge component

needs to be made mandatory in State Govt. Project related to further development of ground water.

5.4 Other interventions proposed:

- Recharge phreatic aquifer (Aq-I) in the area, through construction of artificial recharge structures, viz; sub – surface dams, check dams, step bunds & percolation tanks. 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.
- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate & fluoride concentration is found in ground water samples from Aq-I & Aq-II and requires remedial measures viz. Dilution of nitrate rich ground water through artificial recharge & water conservation, Roof top rain water harvesting, and Micro irrigation.
- The following villages where Aq–I is affected by excess nitrate concentration, there is need to adopt the above mentioned remedial measures: Medinapur, Yelgaldini, Anhosur, Bendoni, Yerjanti, Chickuperi, Bandabhavi, Kadoni, Hatti, Honnali, Yerdoni, Kasargatti Tanda, Chitral, Sarjapur, Mincheri Tanda, Gaudur, Gurgunta, Yerajant,i Raidurg, Machanur, Yelagatti and Mincheri.