केन्द्रीय भूमिजल बोर्ड

जल शक्ति मंत्रालय, जल संसाधन, नदी विकास और गंगा संरक्षण विभाग

भारत सरकार

Central Ground Water Board

Ministry of Jal Shakti,
Department of Water Resources, River Development
and Ganga Rejuvenation
Government of India

Report on

AQUIFER MAPPING AND MANAGEMENT PLAN

Kalaburagi Taluk, Kalaburagi District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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Government of India
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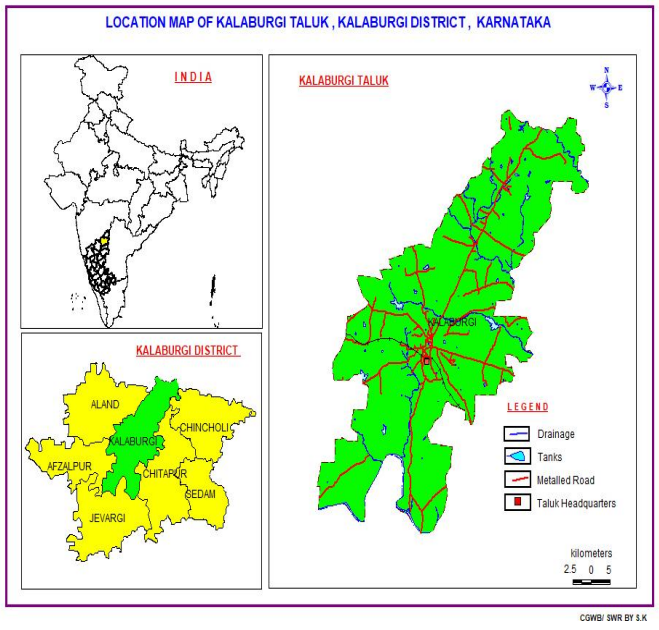
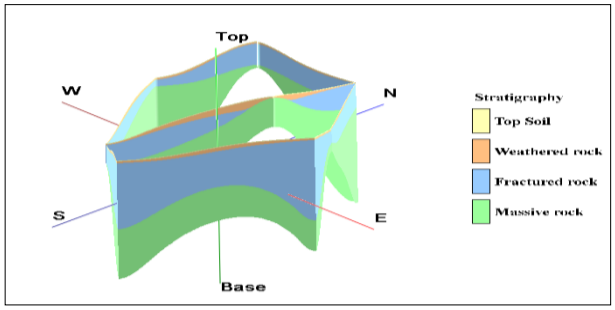
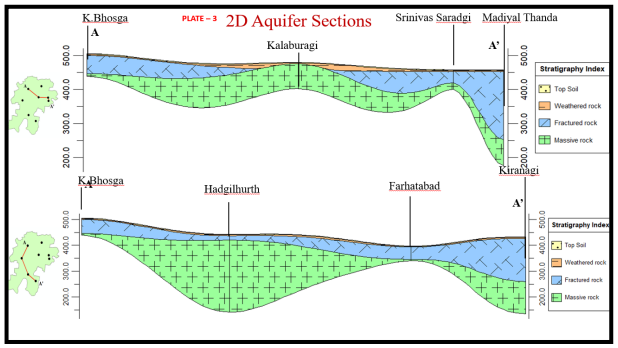
Bengaluru

Aquifer Maps and Management Plan, Kalaburagi Taluk, Kalaburagi District, Karnataka State

(AAP: – 2021-2022)







By

Bijimol Jose, Sc-B, CGWB, SWR, Bengaluru

SEPTEMBER 2022

Aquifer Maps and Management Plan, Kalaburagi Taluk, Kalaburagi District, Karnataka State

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Aquifer Maps and Management Plan, Kalaburagi Taluk, Kalaburagi District, Karnataka State

1. INTRODUCTION

National Project on Aquifer Mapping (NAQUIM) initiated by Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India with a vision to identify and map the aquifers at the micro-level with their characteristics, to quantify the available groundwater resources, to propose plans appropriate to the scale of demand and institutional arrangements for participatory management in order to formulate a viable strategy for the sustainable development and management of the precious resource which is subjected to depletion and contamination due to indiscriminate development in the recent past.

Groundwater is being increasingly recognized as a dependable source of supply to meet the demands of domestic, irrigation and industrial sectors of the country. The development activities over the years have adversely affected the groundwater regime in many parts of the country. Hence, there is a need for scientific planning in development of groundwater under different hydrogeological situations and to evolve effective management practices with involvement of community for better groundwater governance.

Aquifer Mapping has been taken up in Kalaburagi taluk, Kalaburagi district in a view to formulate strategies for sustainable management plan for the aquifer system in accordance with the nature of the aquifer, the stress on the groundwater resource and prevailing groundwater quality. The studies will help in drinking water security and improved irrigation facility. It will also result in better management of vulnerable areas.

1.1 Objectives

The objectives of the aquifer mapping in Kalaburagi taluk, Kalaburagi district can broadly be stated as

- To define the aquifer geometry, type of aquifers and their lateral and vertical extent
- To determine the groundwater regime scenario
- To determine the hydrogeochemical characteristics of the aquifer units
- To define 2D and 3-D dispositions of the aquifer units
- To estimate the availability of groundwater resources in the aquifer system
- To develop a sustainable groundwater management plan for the aquifer system

1.2 Scope of the Study

The important aspect of the aquifer mapping programme is the synthesis of the large volume of data already generated during specific studies carried out by **Central Ground Water Board(CGWB)** and various Government organizations with a new data set generated that broadly describe the aquifer system. The available generated data are assembled, analyzed, examined, synthesized and interpreted from available sources. These sources are predominantly non-computerized data, which is to be converted into computer based GIS data sets.

Data gaps have been identified after proper synthesis and analysis of the available data collected from different state organizations like Ground Water Department (GWD), Watershed Department, etc. In order to bridge the data gap, data generation programme has been formulated in an organized way in the study area. Exploration work has been carried out in different segments of the regions and aquifer parameters have been estimated. Groundwater monitoring regime has been strengthened by establishing/adding State agencies additional monitoring wells. 2D and 3D sections have been prepared to bring out more realistic as the data points are more closure to the field.

1.3 Ground water Issues in the study area

The main issues pertaining to the Kalaburagi taluk are as follows:

- Declining groundwater Level trends in about 50% of the wells analyzed tapping phreatic aquifer during pre and post monsoon periods.
- Poor yield of borewells and drinking water scarcity in summer.
- Ground Water quality: High fluoride concentration in some pockets.
- Water logging and salinity in command areas

1.4 Approach & Methodology

Integrated multi-disciplinary approach involving geological, geophysical, hydrological and hydro-geological and hydro-geochemical components were taken up in 1:50000 scale to meet the objectives of study. Geological map of the study area has been generated based on the GSI maps, geophysical data have been generated through vertical electrical soundings and geo-electrical layers with different resistivity have been interpreted in corroboration with the litho-stratigraphy of the observation wells and exploratory wells down to depths of 302.3 m bgl. Hydrological and Hydro-meteorological data have been collected from Statistical department, Govt of Karnataka. Drainage, Soil and Geomorphology of the taluk were prepared based on the satellite data interpreted by KSRSAC.

Based on the data gap analysis data generation process has been scheduled through establishing key observation wells, integrating Ground Water Directorate observation wells, pinpointing exploratory sites for drilling through in-house and outsourcing, collecting geochemical samples in order to study groundwater regime, geometry of the aquifer and aquifer parameters, and quality of the groundwater respectively. Groundwater recharge and draft have been computed based on approved guidelines and method to estimate the ground water resources of the aquifer system.

Based on the above studies Management strategies both on the supply side through augmentation of groundwater through artificial recharge and water conservation and on demand side through change in irrigation pattern have been formulated for sustainable management of the groundwater resource.

2. SALIENT INFORMATION

Name of the taluk: Kalaburagi

District: Kalaburagi

State: Karnataka

Area: 1730 sq.km

Population: 829830

Annual Normal Rainfall: 863 mm

2.1 Aquifer mapping study area

Aquifer mapping studies have been carried out in Kalaburagi taluk, Kalaburagi district of Karnataka, covering an area of 1730 sq.km under NAQUIM. Kalaburagi taluk is located between North Latitudes 17°29'35" and 17°02'43"and between East Longitudes 77°20'51.52" to 76°37'59" and is falling in parts of Survey of India Toposheets 56C/11, 12, 14 ,15, 16 and 56G/2, 3. The area is bounded on the East by Chitapuar and Chincholi taluks, on the North by Bidar district, on the South by Jewaragi taluk, on the West by Afzalpur and Aland taluks of Kalaburagi district. Location map of Kalaburagi taluk of Kalaburagi district is presented in **Fig.1**. Kalaburagi is the taluk head quarter (76°50'02.19" E - 17°19'40.63" N).

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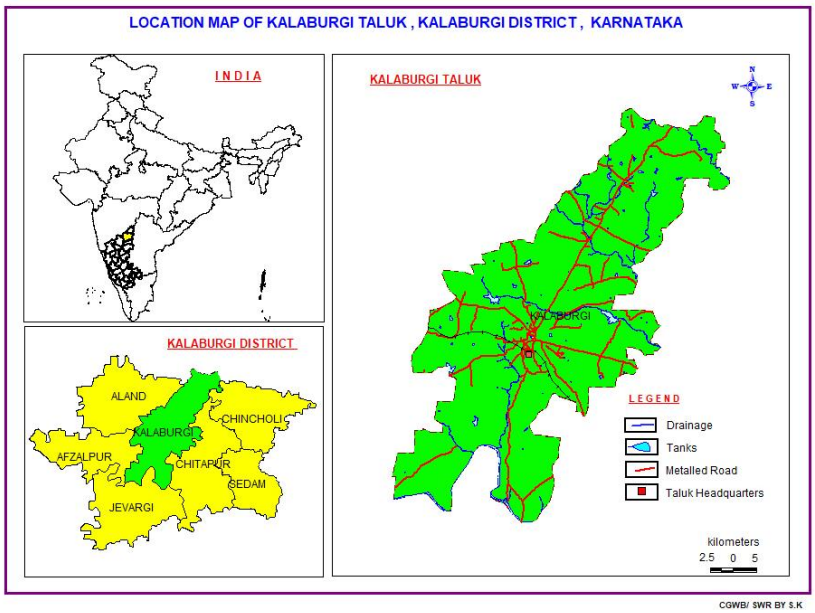

Fig.1: Location Map

2.2 Population

According to 2011 census, the population in Kalaburgi taluk is 829830. Out of which 423051 are males and 406779 are females. Rural and Urban population comprise 286683 and 543147 respectively.

The average sex ratio of Kalaburagi taluk is 966. The taluk has an overall population density of 170 persons per sq.km. The decadal variation in population from 2001-2011 is 14.9 % in the taluk. There are 5 Hoblis, 29 Grama Panchayaths and 148 villages in this taluk.

2.3 Rainfall

Semi-arid climate prevails in Kalaburagi taluk. The area falls under North Eastern Transitional agro-climatic zone of Karnataka. The normal annual rainfall in Kalaburagi taluk for the period 1981 to 2010 is 863 mm. Seasonal rainfall pattern indicates that, major amount of 724 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 78% of the annual normal rainfall, followed by North-East Monsoon season (126 mm) constituting 14% and remaining (74 mm) 8% in Pre-Monsoon season (**Table.1**).

Table.1. Rainfall details of Kalaburagi taluk

Station		Jan	Feb	Mar	Apr	May	Pre	Jun	Jul	Aug	Sep	SW	Oct	Nov	Dec	NE	Annual
KALABURAGI	NRM	7	2	13	20	32	74	128	175	223	198	724	104	18	4	126	923
	STDEV	16	5	30	20	31	48	67	115	137	135	300	76	38	10	84	302
	CV%	215	295	233	101	99	65	53	65	61	68	41	73	214	228	67	33

On Computations were carried out for the 30 year blocks of 1981-2010, the mean monthly rainfall at Kalaburagi taluk is ranging between 2 mm during February to 223 mm during August. The coefficient of variation percent for pre-monsoon, monsoon and post-monsoon season is 65, 41 and 67 percent respectively. Annual Co-efficient Variation at this station works out to be 33 percent (Table-1).

2.4 Assessment of Drought

Rainfall data of Kalaburagi taluk has been analysed for 59 (1961-2019) years using IMD method to assess the drought condition in Kalaburagi taluk. The results of the classification are listed in the **Table.2**.It is observed that the Kalaburagi taluk experienced alternating no drought to severe drought conditions over the years.

Table.2: Classification of drought and its periodicity (IMD, 1971)

% Deviation (Di)		>0	0 to -25	-25 to -50	50 to 75	<-75	Probability of drought occurrences
Category		No drought	Mild (Normal)	Moderate	Severe	Acute	
		Years					
Taluk	Kalaburagi	12	38	8	1	0	Once in **7** years

Out of 59 years of analysis in Kaalburagi taluk, “No Drought” condition is experienced in 12 years, “Mild Drought” condition is experienced in 38 years and “Moderate Drought” condition is experienced in 8 years. Further it is observed that “Severe Drought” condition is experienced in one year during 1972. Based on occurrence and frequency of past drought events, the probability of occurrence of various intensities of drought at each station has been studied. It has been observed that the frequency of occurrence of drought is **once in 7 years** at Kalaburagi taluk.

2.5 Agriculture & Irrigation

Agriculture is the main occupation in Kalaburagi taluk. The taluk is famous as the land of Tuar dal(Pulses) and finest quality Tuar dal is being produced and exported from Kalaburagi. Major Kharif crops are Maize, Bajra, Jowar, Tur and Vegetables. Main crops of Rabi season are Jowar, Maize, Bajra (**Table.3**).Water intensive crops like sugarcane is grown in 5% of total crop area. Jowar is grown in 20% and oil seeds in 5% of total crop area of taluk. Bajra & Maize account 2% of total crop area.

Table.3 Cropping pattern in Kalaburagi taluk 2016-2017 (Ha)

Year	Paddy	Wheat	Maize	Bajara	Jowar	Pulses	Fruits	Vegetables	Oil seeds	Sugarcane	Cotton
		Area under cultivation (in ha)									
2016-2017	5	692	664	2046	23872	90432	1551	909	10607	1430	1093
	Total food grains										
	117711										
	Net sown area(in ha)										
	112537										
	Gross sown area(in ha)										
	108513										

(***Source: District at a glance 2016-17, Govt. of Karnataka)***

It is observed that net sown area accounts 91% and area sown more than once is 22% of total geographical area in Kalaburagi taluk. Area not available for cultivation and Fallow land cover 13% and 4% of total geographical area respectively **(Table 4).** 50% of net area irrigated is only from bore wells and 32% from lift irrigation (**Table.5**). Major part of the irrigated agriculture is through ground water sources. Land use map shown in **Fig 2.**

Table-4: Details of land use in Kalaburagi taluk (Ha)

Total Geographical Area	Area under Forest	Area not available for cultivation	Fallow land	Cultivable waste	Net sown area	Area sown more than once
173165	**4123**	**12847**	**70256**	**4467**	**112537**	**12134**

Source: District at a glance 2016-17, Govt. of Karnataka

Table-5: Irrigation details in Kalaburagi taluk (in sq km)

Source of Irrigation	No	Net area irrigated (sq km)
Canals	42 km	-
Tanks	25	0.63
Wells	3810	23.21
Bore wells	1088	126.46
Lift Irrigation	3	12.95
Other Sources	NA	0.94
Total		**165**

(***Source: District at a glance 2016-17, Govt. of Karnataka)***

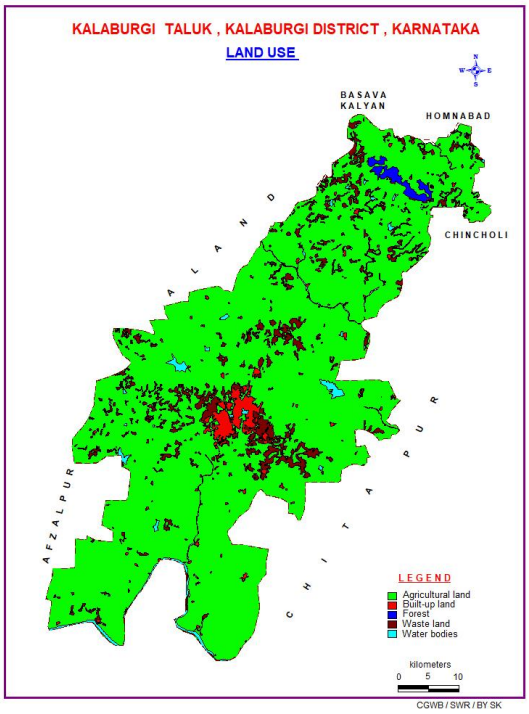

Fig.2: Land use Map

2.6 Geomorphology, Physiography & Drainage

The area is characterized by undulating topography. Geomorphologically, the taluk is a plateau region formed by basaltic lava flows, which represents "Deccan peneplain". The central and southern parts exhibit moderate to gently "undulating terrain" having sparsely distributed knolls and tors. The elevation in the plains varies from 650 m in the North western part to 470 m amsl in the Southern part of the taluk. This has its bearing on the regional slope which is towards south. The differential altitude is significant because, it is likely to cause irregular ground water flow patterns on the micro scale. Topography is dominantly controlled by geological structures. The geomorphological map is shown in **Fig.3.**

The entire Kalaburagi taluk falls in Lower Bhima Basin which is a sub-basin of Krishna river. Tributary of Lowe Bhima- *Bennithoru* flows through Kalaburagi taluk. The drainage map is shown in **Fig.4.**

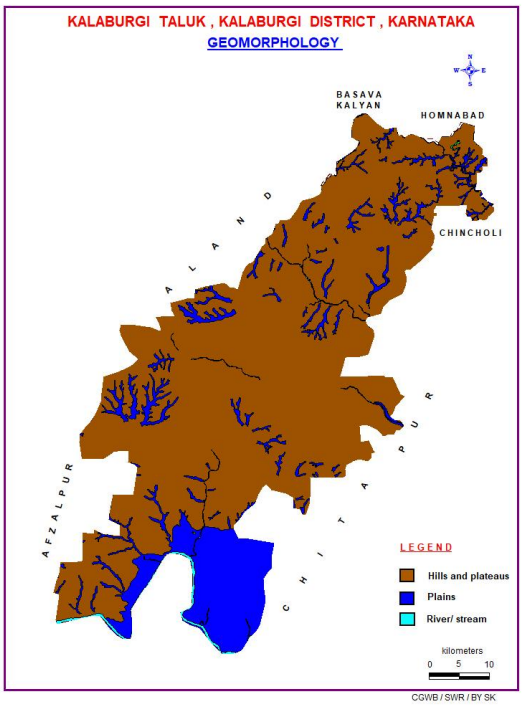

Fig.3: Geomorphology Map

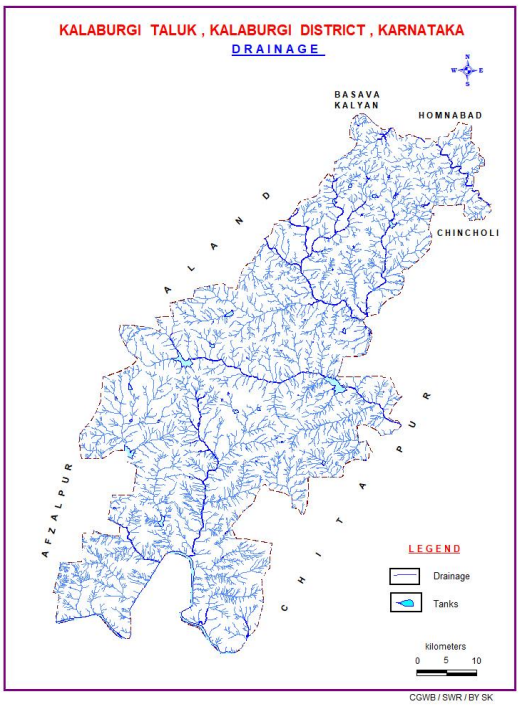

Fig.4: Drainage Map

2.7 Geology

Geologically the area is a part of Lower Bhima basin, which is one of the Proterozoic basins in India. The basement formations of BGC and granites are un-conformably overlain by sedimentary sequence of Bhima series viz Limestone, Shale, Sandstones / conglomerates with a cover of Vesicular and massive Deccan trap Basalts, Laterites **(Fig. 5).**

The Deccan traps of Eocene to Upper Cretaceous age comprise numerous flows, each of which erupted separately. Intertrappean beds of clayey red-bole and green-bole beds occur as horizontal bands in basaltic formations, varying in thickness from two meters to six meters in the taluk. The Deccan trap flows show considerable lateral variation in the area. Weathered products of basaltic flows, lateritic capping is found on uplands and hilltops.

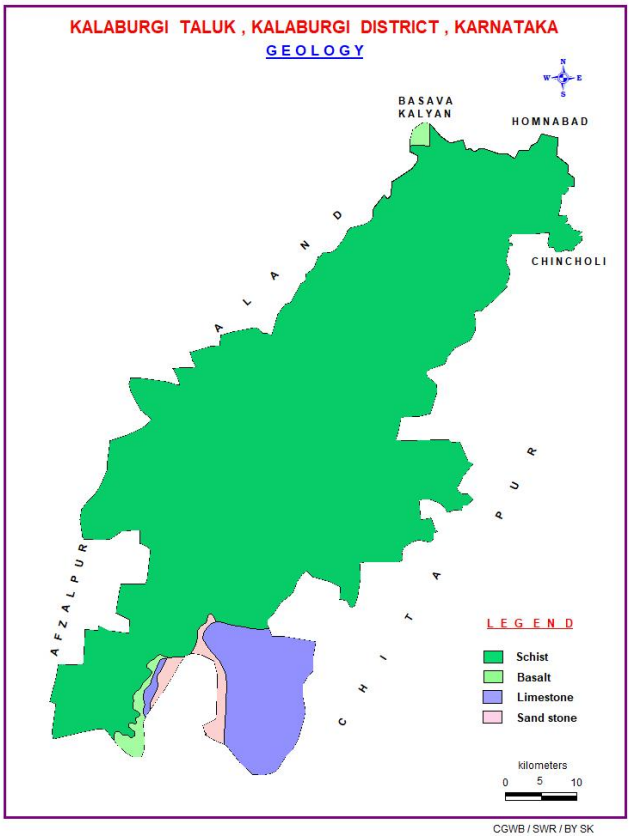

Fig.5: Geology Map

2.8 Soil

The Deep black cotton - clay rich soils cover major part of the taluk. Black cotton soils are mature soils with high humus and are mildly alkaline in nature. Black cotton soil derived from Deccan trap basils are clayey in nature and often form clay layers in the phreatic zone which hinders the recharge and return seepage. Red soils and Lateritic soil form other types of soils. These soils vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions (**Fig.6**).

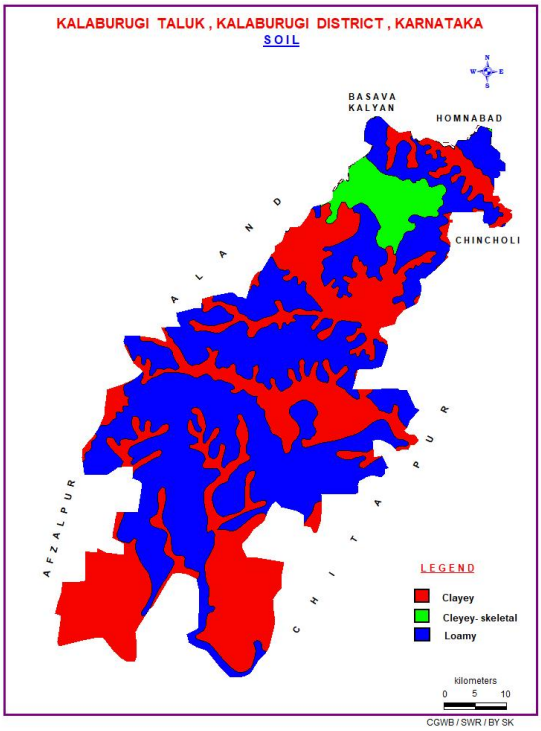

Fig.6: Soil Map

3. AQUIFER CHARACTERISATION

3.1 Aquifer systems

Two aquifer systems have been mapped namely:

Aquifer I: Weathered aquifer down to the depth of 16.65 m bgl

Aquifer II: Fractured aquifer down to the depth of 219.1 m bgl

Aquifer system in Kalaburagi taluk is divided into weathered and fractured aquifers. Limestones, Shales and Basalts constitute the yielding aquifer in the study area. Salient features of the aquifers are given in **Table.6**

Table.6: Summary of Aquifer Characteristics

Aquifer Characteristics	Particulars	Exploratory wells
	• Depth range (mbgl)	41.9 - 220.0
	• Weathering range (mbgl)	1.95 – 16.65
	• Yield range (lps)	0.47 – 11.04
	• Fractures (mbgl)	6.6 – 219.1 (Most of the fractures are encountered beyond the depth ranges of 50 mbgl)
	• Transmissivity (m^2/day)	0.55 – 65.95
	• Static Water Level (mbgl)	2 – 4.78

3.2. Weathered Aquifer (Aquifer I)

The weathered zones of Basalts, Limestones and Shale forms the phreatic aquifer with a minimum thickness of 1.95 m and maximum thickness of 16.65 m bgl with average thickness of 8 m. Groundwater occurs in unconfined condition. Yield of this weathered aquifer ranges from less than 1 lps to 3 lps. During monsoon period the wells tapping this aquifer sustains for one to 3 hrs/day of pumping, while during non-monsoon period (May to July), wells sustains for less than 1 hour/day of pumping.

3.3 Fractured Aquifer (Aquifer II)

Fractured limestones, Shale and Basalt and vesicular basalt comprise the deeper aquifer II occurs from 16.9 to beyond 250 m bgl. Based on the analysis of the 18 bore wells and 58 Vertical electrical sounding data, it is inferred that of the productive fractures are encountered from 50 m- 190 m bgl. The distribution of the fractures with depth is given in **Table 7**. The yield of this aquifer unit II ranges from 0.47 – 11.04 lps. During monsoon period the wells tapping this aquifer unit sustains for 2 to 6 hrs /day of pumping, while during non-monsoon period (May to July) sustains for 1 to 3 hour/day of pumping**.** In general ground water in fractured aquifer is potable.

Table 7: Distribution of fractures in Kalaburagi Taluk

Fractures Encountered (mbgl)						**Yield (**m^3/hr**)**
Nil	**Up to 50**	**50-100**	**100-150**	**150-200**	**> 200**	
6 Nos (25%)	5 Nos (21%)	2 Nos (8%)	4 Nos (17%)	6 Nos (25%)	1 No (4%)	0.3 to 59.4

3.4 AQUIFER DISPOSITION & GEOMETRY

3.4.1 2D & 3D models showing Aquifer Disposition

Aquifer Disposition (Vertical & Lateral) aquifer characterization has been brought mainly by analyzing the data collected from exploratory bore well lithologs (17 Exploratory Wells and & 02 Observation wells) and Vertical Electrical Sounding conducted in the taluk.

2D & 3D aquifer disposition models of the aquifer system have been deciphered by using ROCKWORKS software and 2D cross section have been generated along different directions of Kalaburagi taluk. All such 2D cross sections were verified and the model was calibrated to bring out the 3D aquifer disposition of the

aquifer system. The type cross sectionsgenerated in different direction of the aquifer system is given in **Fig.7, Fig.8,** and 3D aquifer disposition fence diagram in **Fig.9.**

Based on the drilling data the occurrence of three types of aquifers viz., shallow weathered zone, vesicular and fractured aquifers have been inferred. The study of the fence diagram and 3-D block diagram indicates a broad classification of three types of aquifers viz.

- Top weathered zone, which extends down to the depth of 17 m bgl and forms the shallow or phreatic aquifer, tapped mostly by dug wells, dug-cum-bore wells and shallow bore wells.
- Fractured aquifer, Viz fractured basalt, limestones and shales which lies below the weathered zone, extends to a depth of 250 m bgl. This aquifer is being tapped by deep borewells .Columnar joints acts as conduits
- Vesicular Basalt occurring as trap flows between massive basalts which are more prolific aquifer than massive basalts

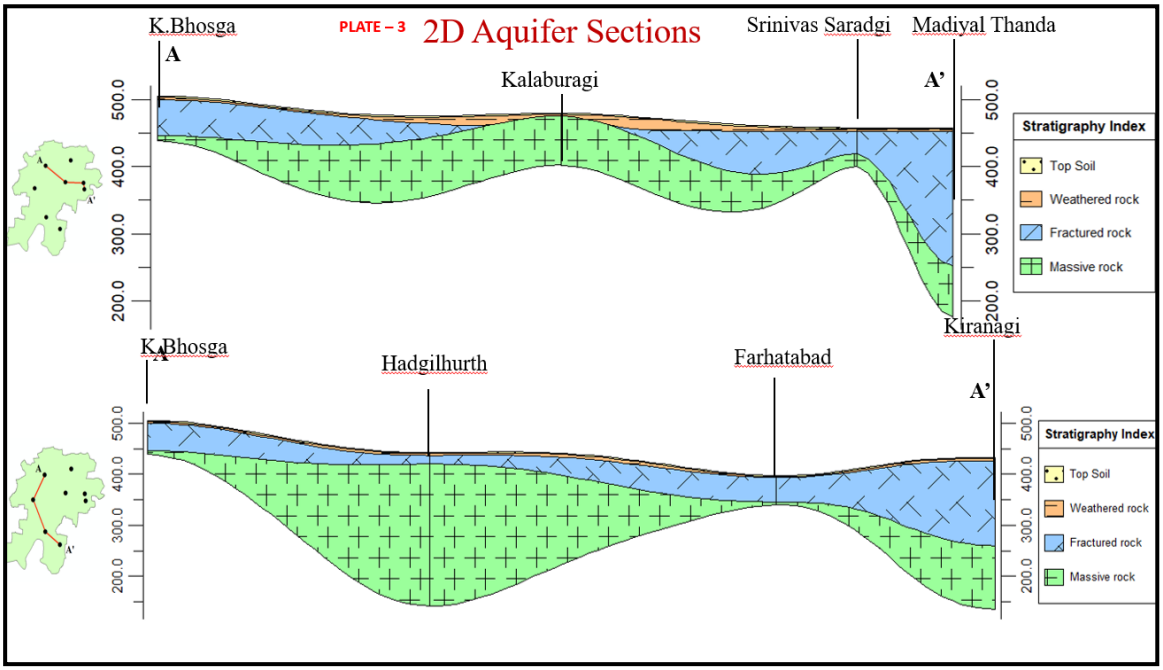

Fig.7:2D cross section of aquifer in Kalaburagi taluk

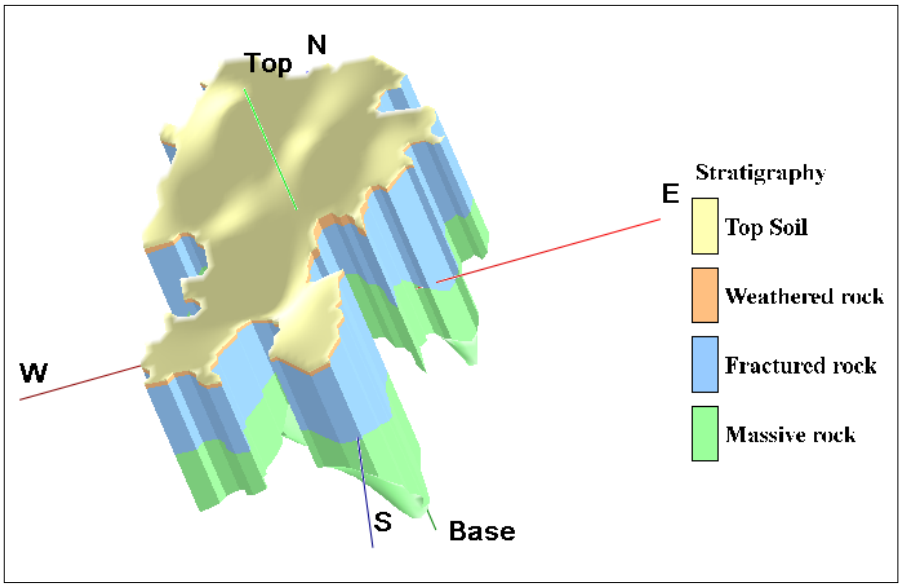

Fig.8:3D section of aquifer in Kalaburagi taluk

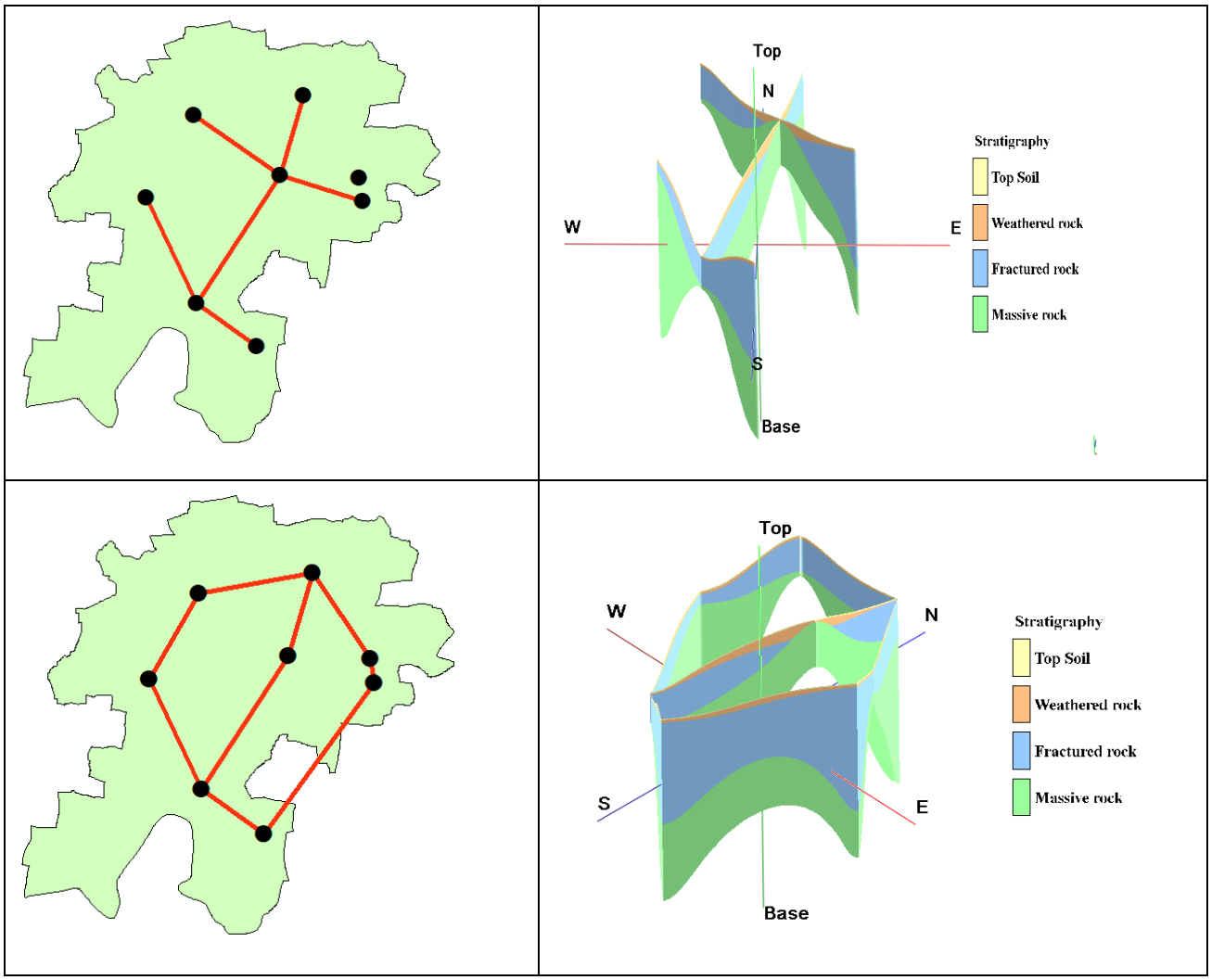

Fig.9:3D Fence Diagram of aquifer in Kalaburagi taluk

Depth to water level behaviors and aquifer characterization conferred the the deeper aquifer is semi-confined in nature and in hydraulic continuity with phreatic aquifer .

3.5 Groundwater Level

During Aquifer Mapping studies, 14 Groundwater monitoring wells were monitored covering the phreatic and fractured aquifers in order to know the behavior of the groundwater regime. The water levels were monitored from May 2010 to January 2019 (four times in a year). The details of the same is presented in **Table.8**

Table.8 Details of wells monitored to study ground water levels

GW Monitoring	Particulars	Dug wells	Piezometers
	• Water level range (mbgl)	10.4 (May 2019)	6.3 to 16.2 (May 2019)
		6.15 (Nov 2019)	1.0 to 18.0 (Nov 2019)

3.5.1 Depth to Water level for (May 2019)

Piezometric head during May 2019 (Aquifer II) has varied from 6.3 to 16.2 m bgl for fractured aquifer. Water level was observed up to 10.5 m in phreatic aquifer. Major part of the taluk shows water level in the range of 5 to 16 m bgl. Isolated patches were recorded water level in the range of 2 to 4 m bgl. Water level ranging more than 20 m bgl is observed in the western parts as a small isolated patch. The depth to water level during pre-monsoon (May 2019) is shown in **Fig.10.**

3.5.2 Depth to Water level (November 2019)

The piezometric head level (in aquifer II) during November 2019 has varied from 1 to 18 mbgl in fractured aquifer. The water level upto 6. 4 m bgl was observed in the phreatic aquifer. Water level in the range of 2 to 10 m bgl was observed in the major part of the study area. Water level ranging less than 2 m bgl is observed as isolated patches in the north western part of the taluk. The depth to water level during post-monsoon is shown in **Fig.11.** The comparison of pre and post monsoon water levels shows that rise in water levels throughout the taluk and thephreatic aquifer is responding to the rainfall and recharging the aquifers.

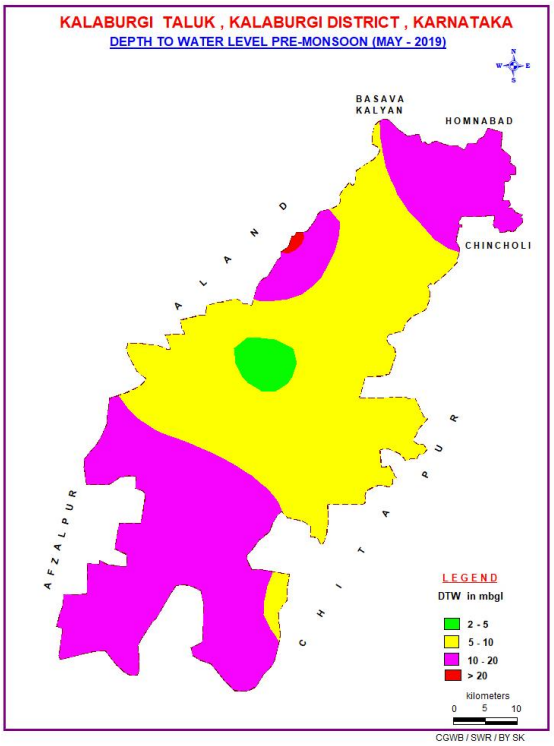

Fig.10: Pre-monsoon Depth to Water Level (Aq-II)

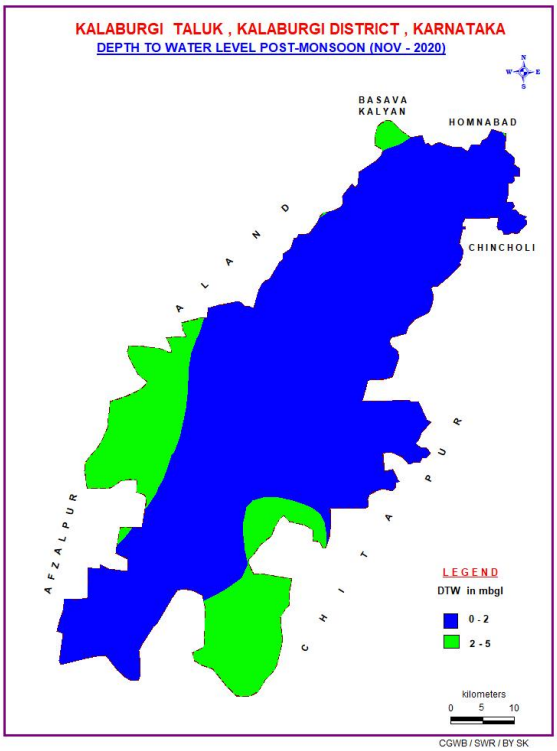

Fig.11: Depth to Water Level, Post-monsoon, Aq-II

3.5 Groundwater Quality

All the groundwater samples of phreatic aquifer have recorded the chloride concentration less than 250 mg/l which is the desirable limit.

The electrical conductivity values are within the permissible limits ranging from 755 to 1520 µS/cm at 25°C. The EC distribution map is shown in **Fig.12.**

The Nitrate content is less than 45mg/l in about 20 % of the sample analyzed and 80 % of sample shows more than 45 mg/l. The nitrate distribution map is shown in **Fig.13**.

About 50% of the groundwater samples of phreatic aquifer have recorded the desirable limit of fluoride content, less than 1 mg/l. Remaining 50 % of wells have recorded beyond permissible limit of more than 1.5 mg/l. The Fluoride distribution map is shown in **Fig.14**. The summarized result of ground water quality is shown in **Table.9.**

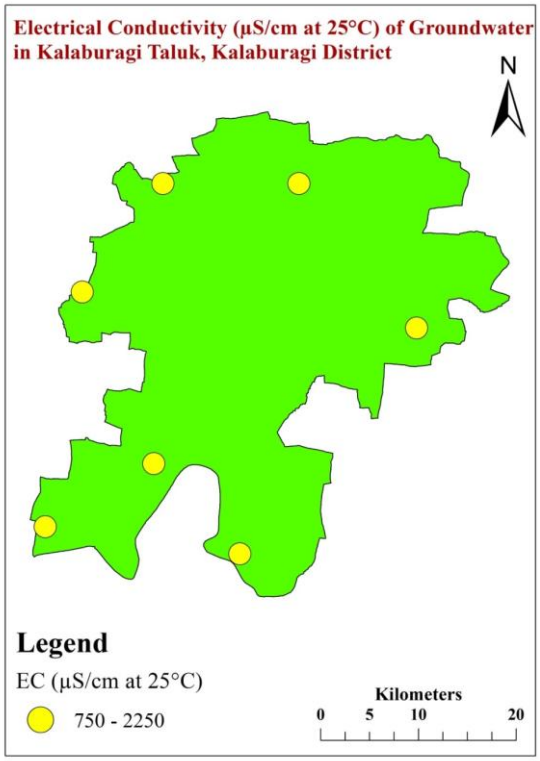

Fig.12:EC distribution map

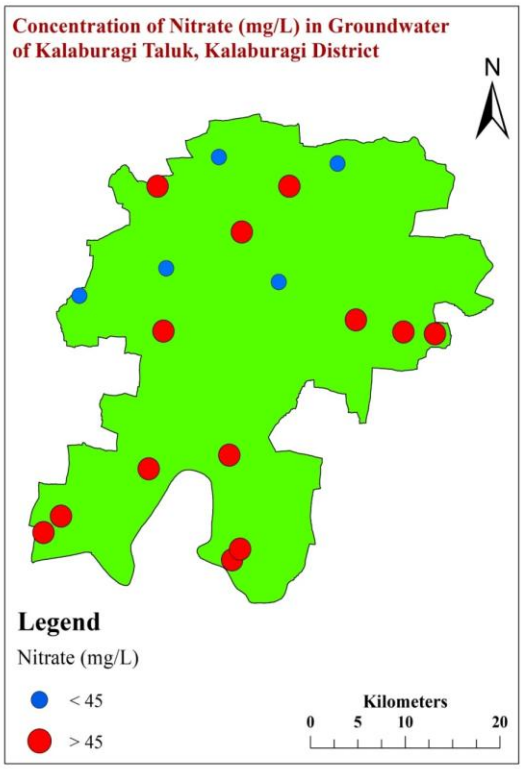

Fig.13:Nitrate distribution map

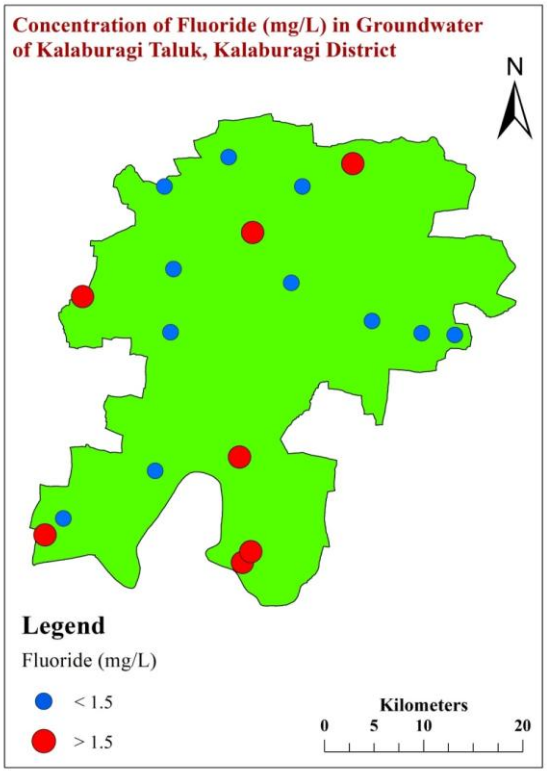

Fig.14. Fluoride distribution map

Table.9: Summarized results of Ground water quality of Kalaburagi taluk (May-2018)

GW Quality:	***Particulars***	***Phreatic Aquifer (Aquifer-I)***	***Fractured Aquifer (Aquifer-II)***
	Electrical Conductivity (EC) (µS/cm at 25°C)	755 - 1520	-
	Fluoride , F (mg/l)	0.38 – 1.9	0.4 – 2.2
	Nitrate, NO_3 (mg/l)	14 - 243	9 -168

4. GROUNDWATER RESOURCES

The dynamic groundwater resources have been estimated as on 2020 based on the methodology suggested by Ground Water Estimation Committee (GEC) 2015.The annual replenishable groundwater recharge is the summation of four components viz.,

- Monsoon recharge due to rainfall
- Monsoon recharge from other sources
- Non-monsoon recharge due to rainfall
- Non-monsoon recharge due to other sources

Taluk wise dynamic groundwater resources have been taken from the approved resourcesestimation done as on March 2020, jointly by Ground Water Department, Govt.of Karnataka and CGWB, to arrive at the dynamic ground water resources available in Kalaburagi taluk.

4.1 Ground water resource availability and extraction

The net groundwater availability refers to the available annual recharge after allowing for natural discharge in the monsoon season in terms of base flow and subsurface inflow/outflow. This annual groundwater potential includes the existing groundwater withdrawal, natural discharge due to base flow and subsurface inflow/ outflow in the monsoon season and availability for future development. As the groundwater development progresses, the natural discharge gets suitably modified and comes down to negligible quantities due to interception by different groundwater structures. Hence, natural discharges in the monsoon season may notbe considered and the total annual groundwater recharge may be taken as net groundwater availability.

As per ground water estimation 2020, in Kalaburagi taluk, the net annual ground water availability is 3688.36 ham. The existing gross ground water draft for irrigation is 1912.32 Ham and draft for domestic is

545.33 ham and the industrial draft is 0 Ham. Thus, the total ground water draft for all uses amounts to 2457.64 Ham **(Table.10).**

Allocation for domestic and industrial water supply for next 25 years is 600.51 Ham. The net ground water availability for future irrigation development is 1175.64 Ham. The existing stage of ground water development is 66.63 % and the taluk falls under **'Safe'** category. The Dynamic ground water resources for Kalaburagi taluk as per earlier 2017 estimates is shown in **Table.11.**The total ground water resources estimated earlier as on 2017 is summarized in **Table.12**

Table.10. Dynamic Ground Water Resources of Karnataka State (March 2020), Kalaburagi taluk

Annual Extractable Ground Water Resource (Ham)	Ground Water Extraction for Irrigation Use (Ham	Ground Water Extraction for Industrial Use (Ham)	Ground Water Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for Domestic Use as on 2025 (Ham) Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net Ground Water Availability for future use (Ham	Stage of Ground Water Extraction (%)	Categorization (OE/C/SC/ Safe/Saline)
3688.36	1912.32	0	545.33	2457.64	600.41	1175.64	66.63	Safe

Table.11. Dynamic Ground Water Resources of Karnataka State (March 2017), Kalaburagi taluk

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 Extraction	Category
Kalabaragi	5904	2574	817	3390	912	2418	57	SAFE

Table.12.Total GW Resources-2017 (Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW
		Phreatic	Fractured (Down to 200m)	Dynamic +Fresh in-storage
Kalabaragi	5904	0	2304	8208

(Source: Report of Groundwater Resources of Karnataka - March-2017)

The comparison of groundwater availability and draft scenario between 2017 and 2020 is presented in **Table.13.** It is seen that ground water availability is found to be reduced during 2020 in comparison with 2017.At the same time, the stage of ground water extraction is found to be increased from 57 % to 67% during the same period.

Table.13. Comparison of ground water availability and draft scenario (in ham), Kalaburagi taluk.

2017			**2020**		
GW Availability	**GW Extraction**	**Stage of GW Extraction**	**GW Availability**	**GW Extraction**	**Stage of GW Extraction**
5904	3390	**57%**	3688	2458	**67%**

5 GROUND WATER RESOURCE ENHANCEMENT

5.1 Resource Enhancement by Supply Side Interventions

The Master Plan for Artificial recharge to ground water prepared by CGWB (2020) recommended to replenish the desaturated aquifer system , both phreatic & deeper **(Aquifer I & II)** in the taluk through construction of artificial recharge structures, viz; check dams, percolation tanks & Sub surface dyke is suggested (**Table.14**). As of now, recharging dried-up phreatic aquifer in the taluk, through construction of artificial recharge and watershed treatment structures has already been taken up by state Government agencies and is being implemented under MGNREGA. 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. Scientific site selection of AR structures is a prerequisite to improve the efficacy of Managed Aquifer Recharge. Area feasible for artificial recharge in the taluk is shown in **Fig.15.**

Table-14: Quantity of non-committed surface runoff & expected recharge through AR structures

Area feasible for Artificial Recharge Structures(sq.km)	967
Non committed monsoon runoff available (MCM)	48.355
Total no. of existing Artificial Recharge Structures	405
Number of Check Dams proposed	70
Number of Percolation Tanks proposed	26
Number of Sub surface dyke proposed	1
Tentative total cost of the project (Rs. in lakhs)	1235.139
Expected recharge (MCM)	36.267
Likely additional irrigation potential to be cerated(Lakh.Ha)	0.004

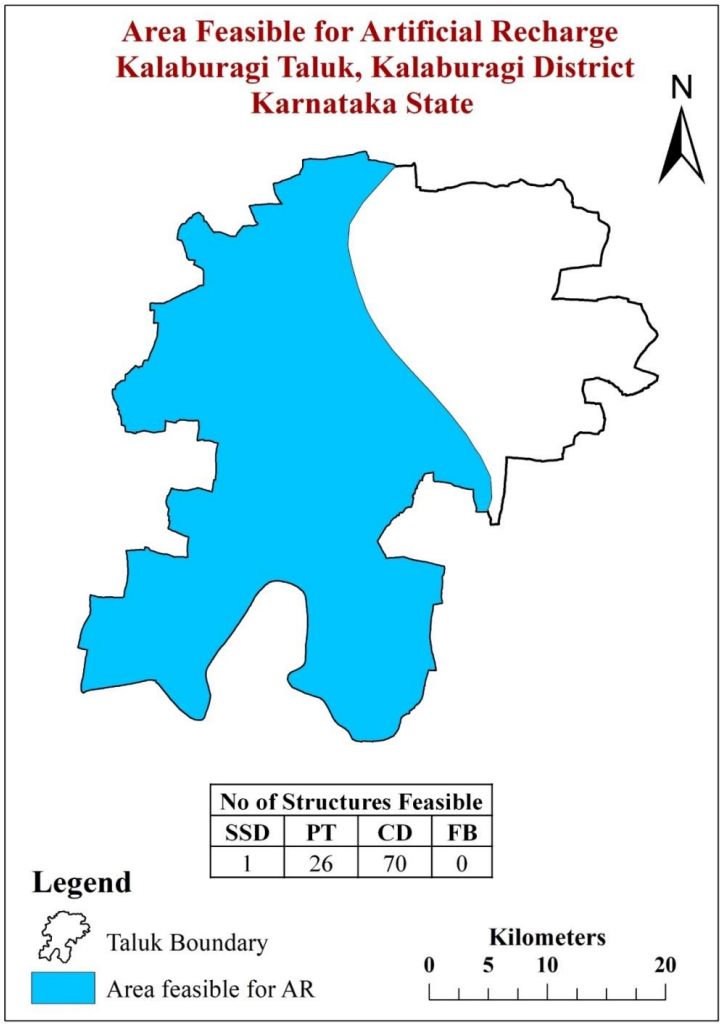

Fig.15:Area Feasible for Artificial Recharge, Kalaburagi Taluk

5.2 Resource Enhancement by Demand Side Interventions

5.2.1 Advanced irrigation practices

The important crops grown are jowar, bajra, gram, tur, groundnut, sunflower and sugarcane About 314 sq.km area is being by canal irrigation and the remaining part of the irrigated area is fed by ground water. In view of this, Water Use Efficiency (**WUE**) practices like Drip needs to be strengthened to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation potential.

The details of the resource enhancement through water conservation and artificial recharge taluk and also through Water Efficiency practices in Irrigation are shown in **Table.15.**

Table.15 Improvement in GW availability due to Recharge, Kalaburagi taluk

Sl. No.	**Resource Details**	**As per 2020 Estimation**
1	Net Ground Water Availability in Ham	3688
2	Existing ground water draft for all uses in Ham	2458
3	Existing Stage of Ground Water Development in percentage %	**67**
4	Expected Recharge from Artificial Recharge sources in Ham	3627
5	Cumulative Ground water availability in Ham	7315
6	Expected improvement in stage of ground water development %	**34%**
8	Saving due to adopting Water Use Efficiency in Ham	382
9	Ground water availability after AR & WUE in Ham	7697
10	Expected improved stage of ground water development after implementation of AR & WUE %	**32%**
12	Cumulative improved stage of ground water development after all implementation %	**35 %**

5.3 Ground Water Development Plan

In Kalaburagi taluk, the present stage of ground water extraction (2020) is 67 % with net ground water availability for future use is 1176 ham and total extraction is 2458 ham (2020) The ground water draft for irrigation purpose is 1912 ham, thus indicating that ground water irrigation needs to be encouraged in the area after considering the "Safe" level of extraction of 70%, which can be implemented in scientific manner. The implementation of the plan needs to be based on site specific detailed hydrogeological, geophysical and scientific surveys for pinpointing the sites for construction of dug wells and bore wells.

As per the conservative estimate and after considering the average unit draft figure for the taluk, about 150 dug wells (10-15 m depth; 3 to 5 m diameter) are recommended to be constructed in feasible areas. Further. as per the estimate about,1000 bore wells (100 to 200 m depth; 150 mm dia) are also recommended to be drilled in feasible areas so as to maintain the safe category of the taluk. The likely additional irrigation potential which can be created considering prevailing crop water requirement for the area is will be 1175 ha.

5.4 Conjunctive use plan in water logged area

Out of the total 314.23 sq.km of the canal command area in the taluk, under Kagina Command (Irrigation project Zone) about 3575 ha is water logged. About 1294 ha of this is reclaimed and 2281 ha is yet to be reclaimed since inception. (Source: CADA as on March 2021). In addition to this reclamation, conjunctive use plan is also recommended to benefit the tail end area of the irrigation command.

5.5 Regulation and Control

As per the resource estimation – 2020, Kalaburagi taluk falls under "**Safe"** category with the stage of ground water extraction of 67**%**. However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented in the taluk, so that quality of ground water will improve in due course of time.

5.6 Other interventions proposed

- Remedial measures need to be adopted in the areas affected by Nitrate and Fluoride rich ground water through artificial recharge and water conservation etc.
- 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.
- Periodical maintenance of artificial recharge structures should be incorporated in the Recharge Plan.
- Augmenting surface water supply from nearby sources

- Intense monitoring of water level is recommended to keep an eye on water level trend in the Taluk.
- Awareness programmes and practice of participatory approach needs to be strengthened with the involvement of all the stake holders for sustainable management.

6. SUMMARY OF MANAGEMENT PLANS

- **Ground Water resource**: As per the resource estimation – 2020, Kalaburagi taluk falls under "Safe" category with the stage of ground water extraction of 66.63 %. However, there is need to formulate management strategy to tackle the water scarcity related issues in the taluk during the summer and scarcity of water during the future days.
- **Ground water resource enhancement**: Increase in agricultural activity, excessive ground water withdrawal, depletion of ground water levels, reduction in yield and ground water quality related issues etc., suggests the need for scientific ground water management, enhancement of storage capacity of the aquifers and protection of ground water quality.
- **Quantity of water available through non-committed surface run-off:** The surplus non-committed monsoon run off is estimated to be approximately **48.355** MCM. This can be used to recharge the aquifer mainly through percolation tanks (about 26) and check dams (about 70) as per CGWB, 2020 figures. In view of the formation of new Kamalapura taluk, part of the above figures will shift to this new taluk.
- **Advanced irrigation practices:** The important crops grown are jowar, bajra, gram, tur, groundnut, sunflower and sugarcane About 314 sq.km area is being by canal irrigation and the remaining part of the irrigated area is fed by ground water. In view of this, Water Use Efficiency (WUE) practices like Drip needs to be strengthened to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation potential.
- **Conjunctive use plan in water logged area:** Out of the total 314.23 sq.km of the canal command area in the taluk, under Kagina Command (Irrigation project Zone) about 3575 ha is water logged. About 1294 ha of this is reclaimed and 2281 ha is yet to be reclaimed since inception. (Source: CADA as on March 2021). In addition to this reclamation, conjunctive use plan is also recommended to benefit the tail end area of the irrigation command.
- **Change in cropping pattern**: Farmers are facing inadequacy of groundwater for agriculture during summer and can opt for more rain-fed millets and water efficient Pulses for agricultural production.
- **Drinking water Supply**: In view of ground water contamination with mainly higher concentration Nitrate and fluoride, drinking water supply from surface water needs to be explored/ ensured.

- **Regulation and Control**: Taluk is categorized as "Safe". However, the mandatory guidelines like rainwater harvesting and artificial recharge issued by Karnataka Ground Water Authority needs to be strictly implemented in the taluk, so that quality of ground water will improve in due course of time.
- **Participatory management**: Awareness programmes and practice of participatory approach needs to be strengthened with the involvement of all the stake holders for sustainable management.
- **Other Management Options proposed:**
    - Scientific disposal of sewage water by the concerned agency
    - Periodical maintenance of artificial recharge structures is recommended for better recharge and long life of the structure
    - RTRWH from each building and in-situ storage and use /mixing with surface water supply or groundwater in urban areas.
    - Priority to promote recycle and reuse of grey water effectively in urban pockets.
- **Water Linkages with other Activities:** Water sector has strong linkages with other developmental activities. Hence, the proposed management plans cannot be considered as static and needs to be reviewed and improved from time to time.