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

Kanakapura Taluk, Ramanagara District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
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Government of India
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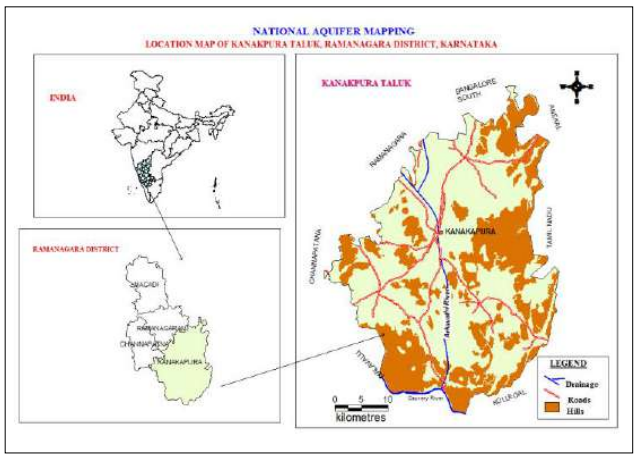
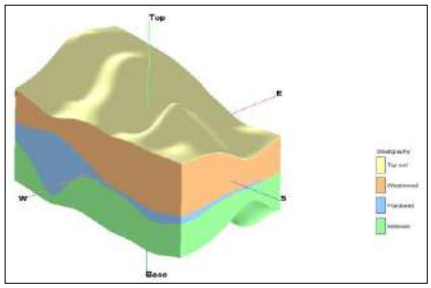
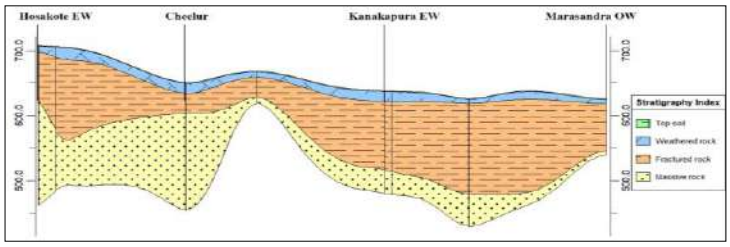
AQUIFER MAPS AND MANAGEMENTPLAN, KANAKAPURA TALUK, RAMANAGARA DISTRICT, KARNATAKA STATE

(AAP: – 2020-2021)







By

RAKHI.U.R, Scientist 'B', CGWB, SWR, Bengaluru

AUGUST 2022

AQUIFER MAPS AND MANAGEMENT PLAN, KANAKAPURA TALUK, RAMANAGARA DISTRICT, KARNATAKA STATE

(AAP: – 2020-2021)

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AQUIFER MAPS AND MANAGEMENT PLAN, KANAKAPURA TALUK, RAMANAGARA DISTRICT, KARNATAKA STATE

1 SALIENT FEATURES

Nameofthetaluk : KANAKAPURA

District : Ramanagara

State : Karnataka

Area : 1594 Sq.km.

Population : 3,50,877

Annual NormalRainfall: 799 mm

1.1 Studyarea

Aquifer mapping studies have been carried out in Kanakapurataluk, Ramanagaradistrict of Karnataka, covering an area of1594sq.kmsunder National Aquifer MappingProject. Kanakapurataluk of Ramanagaradistrict is located between North Latitudes12°14'40" and 12°47'58"&East Longitudes77°13'34"and77°38'07" and is covered in parts of Survey of India Toposheet Nos. 57H/6, 57H/7, 57H/9, 57H/10 and 57H/11. Kanakapurataluk is bounded by Anekaltaluk on North West, Bangalore South taluk on North,Ramanagara on North East, Channapatna on East, Malavalli on South East, Kollegal on South and Tamil Nadu on West.Location map of Kanakapura taluk of Ramanagaradistrict is presented in **Fig.1.**

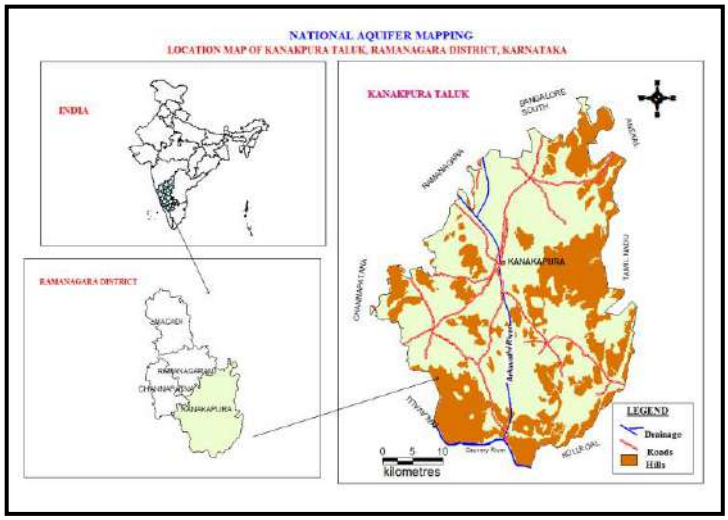


Fig.1: LocationMap

Kanakapura taluk is located in Ramanagara District of Karnataka State. Taluk administration of Kanakapurataluk is divided into 6Hoblies and 43 Grama Panchayaths. There are 239 inhabited and 20 uninhabited villages in the taluk.

1.2 Population

According to 2011 census, the human population in Kanakapura taluk is 350877 out of which 85% constitutes the rural population and only 15% constitute the urban population. The taluk has an overall population density of 226 persons per sq.km. In Kanakapura taluk, the

decadal variation in population from 2001-2011 is 4.05%. The population details are given in **Table-1.**

Table-1: Population details

Total	Male	Female	Share of the district population	Rural population	Urban population	Decadal change in population	Decadal change in rural population	Decadal change in urban population
350877	178572	172305	32.40	296863	54014	4.05	2.31	14.78

Source: District at a glance 2015-16, Govt. of Karnataka

1.3 Rainfall and Climate

The Kanakapura taluk enjoys semi-arid climate. Dryness and hot weather prevail in major part of the year. 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.

Bulk of the rainfall is contributed by SW Monsoon i.e., during June to September. In general, humid to semi-arid climatic conditions prevail in the area. The average temperature is around 25.92 ˚C (2020). Seasonal and Annual rainfall data of the Taluk during 2020& 2021 is given in **Table 2a.** Actual Monthly rainfall data is given in **Table 2b.**

Table 2a: Normal & Actual Rainfall (mm)

Year	**Pre monsoon (Jan- May)**		**SW monsoon (Jun- Sep)**		**NE monsoon (Oct- Dec)**		**Annual Rainfall (Jan- Dec)**	
Rainfall mm	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual
2020	187	218	383	529	226	221	**797**	**969**
2021	187	177	383	388	226	494	**797**	**1059**

Source:KSNDMC, Karnataka

Table 2b: Actual monthly Rainfall (mm)

Year	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
2020	218					114	152	57	207	158	41	16	**963**
2021						61.8	123.6	79.4	123	212	244	38	

Source:KSNDMC, Karnataka

1.4 Agriculture and Irrigation

Agriculture is the main occupation inRamanagarataluk, since 85% of the total population constitutes the rural population. The amount of rainfall and its distribution throughoutthe season contributes to the cropping pattern in the area. There are two agricultural seasons namely Kharif (June to October) and Rabi season (Mid October to Mid-February). Major Kharif crops are paddy and vegetables. Maincrops of Rabi season are pulses and oilseeds which together constitute 3534 ha of cropped area.

Water intensive crops like sugarcane and paddy are grown in 0.5 and 4.7% respectively

of the total crop area. However, paddy is grown during Kharif period and is mainly dependent on rain water. Ragi is grown in 57%, Maize in 0.3%, Fruits in 9.1%, Vegetables in 0.6% and Oil seeds grown in 13.5% of total crop area in the taluk. Bajra is grown in very small area of 7 ha (0.03%). Bajra, Jowar, Wheat and Cotton are not grown in this taluk. **(Table 3)**

Table 3: Cropping pattern

Crop	Paddy	Maize	Bajra	Jowar	Ragi	Wheat	Pulses	Fruits	Vege tables	Oil seeds	Sugar cane	Cotton	Total crop
Area(ha)	2388	161	0	0	28983	0	7285	4629	306	6848	241	0	50841
Area %	4.7	0.3	0	0	57	0	14.3	9.1	0.6	13.5	0.5	0	100

Source: District at a glance 2015 - 16, Govt. of Karnataka

About 28.4% of the geographical area is covered by forest. It is observed that net sown area accounts for 38.4% and area sown more than once is 2.4% of total geographical area in Ramanagara taluk. Area not available for cultivation, the other uncultivable land and fallow land cover 14%, 8.2% and 11% respectively of total geographical area. About 58.6% of net area irrigated is from bore/tube wells and the major part of irrigation is from ground water. Thus, major source of irrigation is ground water **(Fig.-2)** and the irrigation from other sources is only 41.4%. The details of land use and the details of Irrigation are given in **Table 4 and 5** respectively. The land use pattern is given in **Fig.-3**.

Table 4: Land use pattern

TotalGeographical Area	Area under Forest	Area not available for cultivation	Other uncultivable land	Fallow land	Net sown area	Area sown more than once	Gross sown area
159426	45263	22373	13144	17466	61180	3830	65010
% of the area	28.4	14	8.2	11	38.4	2.4	40.8

Source: District at a glance 2015 - 16, Govt. of Karnataka

Table 5: Irrigation sources

Source of Irrigation	Length in km/No of structures	Gross area Irrigated (Ha)	Net area Irrigated (Ha.)	% of area
Canals	18	5523	4930	34.3
Tanks	239	875	830	5.8
Wells	3456	0	0	0
Bore/Tube wells	12738	8461	8428	58.6
Lift Irrigation	1	205	195	1.3
Other Sources	0	0	0	0
Total	16434	15064	14383	100

Source: District at a glance 2015 - 16, Govt. of Karnataka

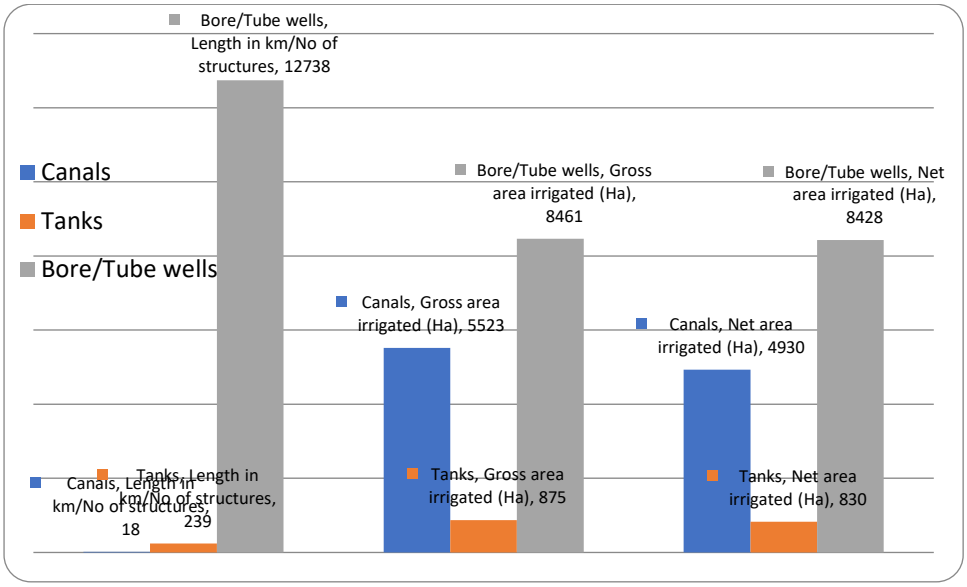


Fig 2: Irrigation Sources

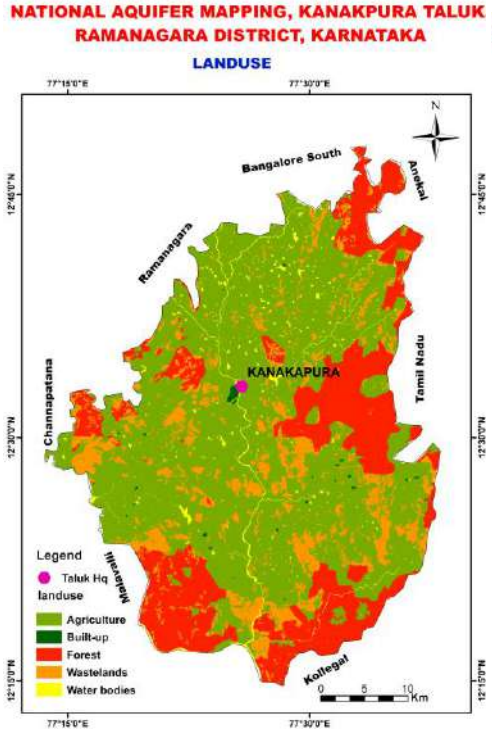


Fig.3: Landuse Map

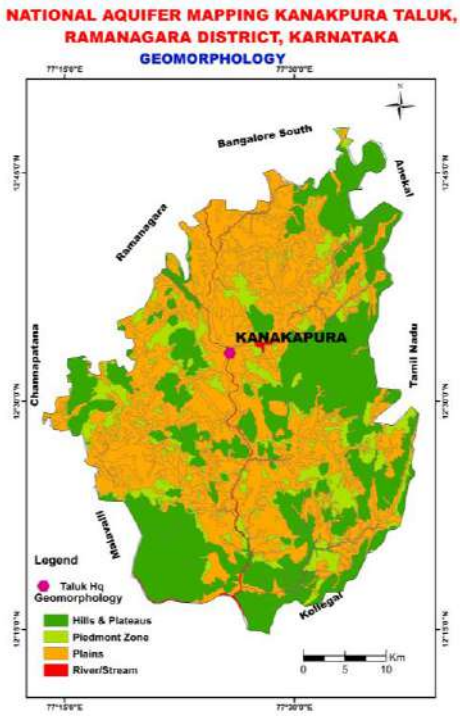


Fig.4:Geomorphology Map

1.5 Geomorphology, Physiography and Drainage

Geomorphologically, the entire taluk is divided into residual hills, plateaus, pediment zone and plains about 900 m amsl**(Fig.4)**. Geomorphologically the Ramanagara district can be divided into rocky upland, plateau and flat topped hills at an elevation of about 900 m amsl. The pediplain form major part of the taluk underlain by gneisses and granites with the highest pediplain in the range of 850 m to 950 m amsl. Rocky upland pediplain and plateau constitute erosional topography. Major part of pediplain constitutes low relief area having matured dissected rolling topography with erosional landscape covered by layers of red soil of varied thickness. Major parts of the pediplain are dissected by streamlets flowing in southerly direction. An alluvial valley with low relief of 600 – 650 m is located in Kanva plain. The entire

taluk is drained by Cauvery River basin **(Fig.5).**

1.6 Soil

The taluk is occupied Clayey soil, Clayey mixed and Clayey Skeletal and rocky land. Formation of various types of soils is a complex function of chemical weathering of bedrocks, vegetative decay and circulation of precipitated water. Soils are mostly insitu in nature**(Fig.6)**.

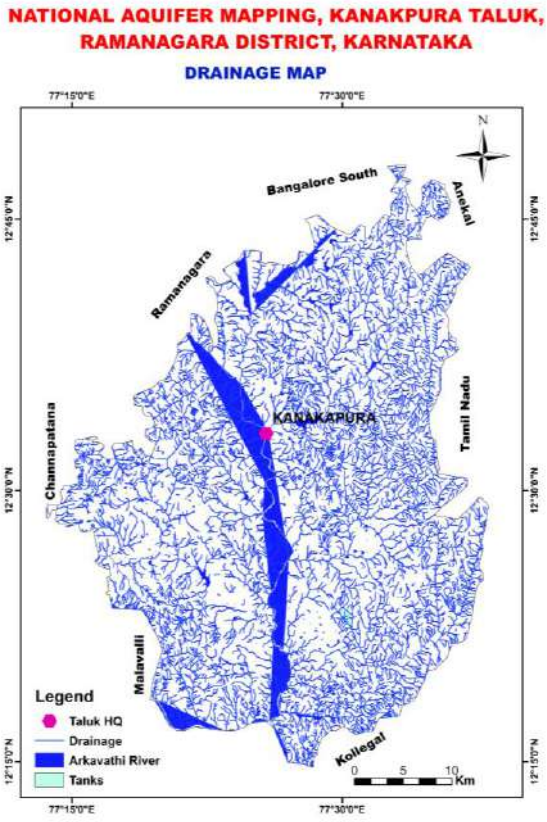


Fig.5:Drainage Map

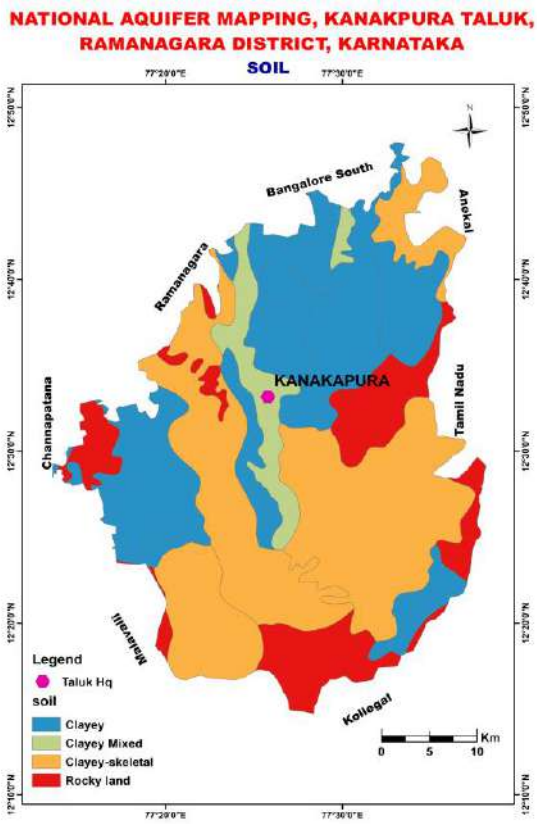


Fig.6: Soil Map

1.7 Ground water resource availability and extraction

As per the ground water resource estimation 2017 **(Table 6a),** the data on ground water resources shows that the net annual ground water availability is 13462 ham. The existing gross groundwater for irrigation is 13057 ham. The stage of groundwater development is 102% and falling under 'Over Exploited' category.Aquifer-wise total ground water resources down to 200 m depth are given in **Table-6b** below as per 2017 estimations.

1.8 Existing and future water demands (as per GEC-2017 and 2020)

As per the GWRA 2017, the net ground water availability is 13462 ham and the total ground water draft for all uses is 13694 ham with stage of development at 102% and the taluk falls in Over Exploited category. The domestic (Industrial sector) demand for next 25 years is estimated at661 Ham.

Table.6aDynamic Ground Water Resources (March 2017 Figures in Ham)

Net Annual	Existing Gross	Existing Gross GW	Existing Gross	Allocation For	Net Ground Water	Existing Stage of Ground	Category

Ground Water Availability	Ground Water Draft for Irrigation	Draft For Domestic And Industrial Water Supply	Ground Water Draft For All Uses	Domestic And Industrial Use For Next 25 Years	Availability For Future Irrigation Develop-ment	Water Development	
13462	13057	637	13694	661	498	102	OE

Table.6b Total Ground Water Resources (2017) (Ham)

Taluk	Annual ReplenishableGW resources	Fresh In-storageGWResources (Phreatic)	Total availability of fresh GWResources (Dynamic + Phreatic instorage)
Kanakpura	13462	14521	27983

The details of dynamic (Phreatic) ground water resources for Kanakapura taluk as on March 2020 is shown in **Table.7.** It is observed that the stage of ground water extraction is slightly gone down, almost reduced in 10% in the taluk from 102 % to 92.37 % from 2017 to 2020.

Table.7 Detail of Dynamic Ground Water Resource, (as on March 2020)

Annual Extractable GW Resource (Ham)	GW Extraction for Irrigation Use (Ham)	GW Extraction for Industrial Use (Ham)	GW Extraction for Domestic Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for for Domestic Use as on 2025 (Ham)	Net GW Availability for future use (Ham)	Stage of GW Extraction (%)	Categorization (Over-Exploited/ Critical/ Semi-critical/ Safe/Saline)
16191.31	14349.68	0.00	606.32	14956.0	755.25	1274.54	92.37	Critical

1.9 Hydrogeology

(a) Hydrogeology of Phreatic Aquifer

The weathered thickness ranges from 4m to 20 m. The premonsoon depth to water level ranges from 4 mbgl to 13 mbgl. The yield of the phreatic aquifer ranges from 0.4 to 0.8 m^3/hr and sustainability is less than 1 hour.Aquifers not sustainable for longer duration pumping and becomes desaturated**(Fig 7)**.

(b) Hydrogeology of Fractured Aquifer

The major formations are fractured Granites and Gneisses. The pre-monsoon piezometric head ranges from 15.26 mbgl to 44.5 mbgl. The yield of the fractured aquifer ranges from 0.5 to 36 m^3/hr and sustainability is less than 1 hour to 2 hrs during non-monsoon and 2 to 4 hrs during monsoon **(Fig 8)**.

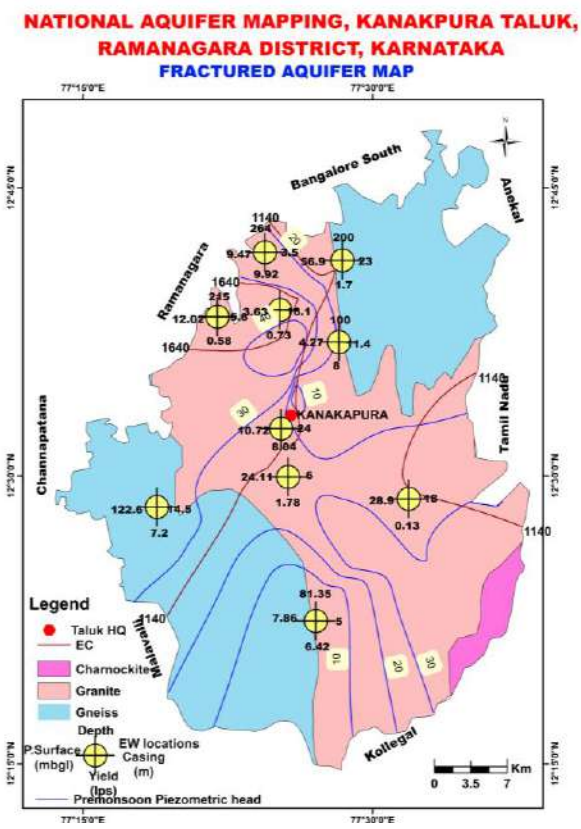


Fig 7: Hydrogeology of Phreatic Aquifer

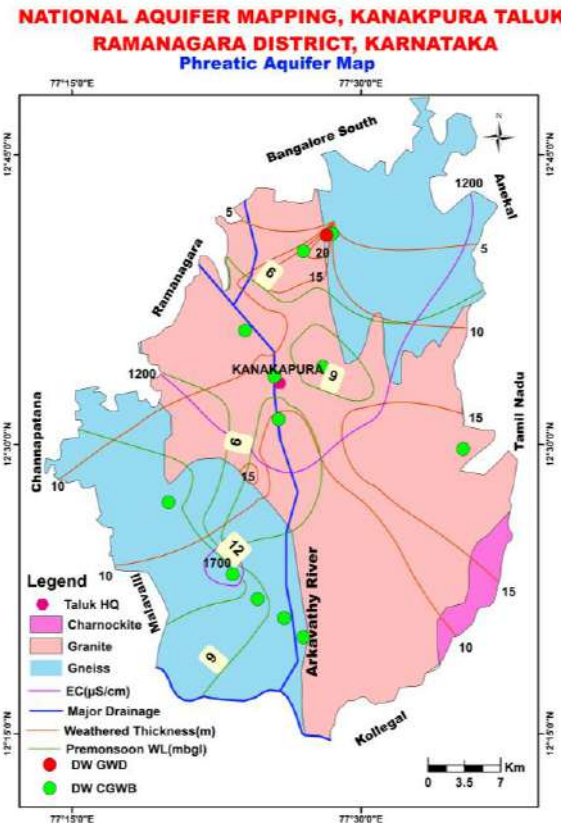


Fig 8: Hydrogeology of Fractured Aquifer

1.10 Water level behaviour

Depth to water level

Aquifer – I (Phreatic)

- Pre-monsoon: 3.53 – 20 mbgl**(Fig.9)**
- Post-monsoon: 0.7 - 10.5mbgl**(Fig.10)**

During pre-monsoon, water level map shows that in 20% of the area, water level ranges between 2 to 5 mbgl, in 50 % of the area, water level ranges between 5 to 10 mbgl and in 30% of the area, water level is greater than 10mbgl. During post monsoon, water level map shows that in 50 % of the area, water level ranges in between GL and 2mbgl, in 25 % of the area, water level ranges in between 2 and 5 mbgl, 20% of the area shows greater than 5 to 10 mbgl and 5%of the area is greater than 10 mbgl.

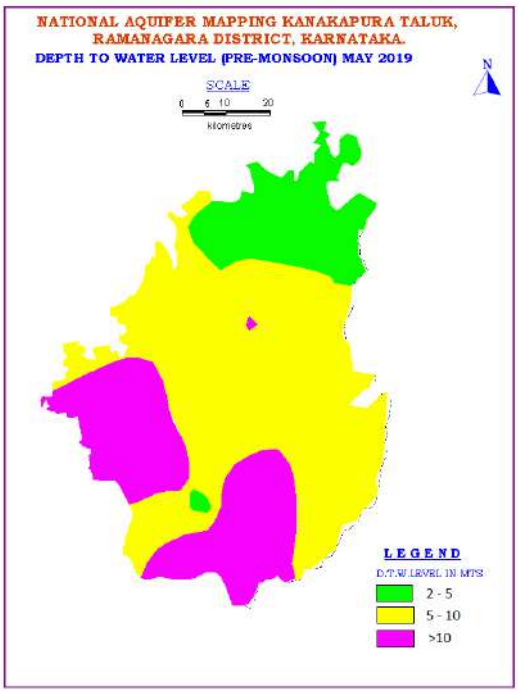
2 AQUIFER DISPOSITION

The occurrence and movement of water in the subsurface is broadly governed by geological frameworks i.e., nature of rock formations including their porosity (primary and secondary) and permeability. The principal aquifers in the area are Granite and Banded Gneissic complex and the occurrence and movement of ground water in these rocks is controlled by various factors and it primarily depends on the degree of interconnection of secondary pores/voids developed by fracturing and weathering in the hard rock.

2.1 Aquifer Types

In Kanakapura taluk, there are two types of aquifer systems;

- **Aquifer-I (Phreatic aquifer)** comprising Weathered Granite and Banded Gneissic Complex
- **Aquifer-II (Fractured aquifer)** comprising Fractured Granite and Banded Gneissic Complex



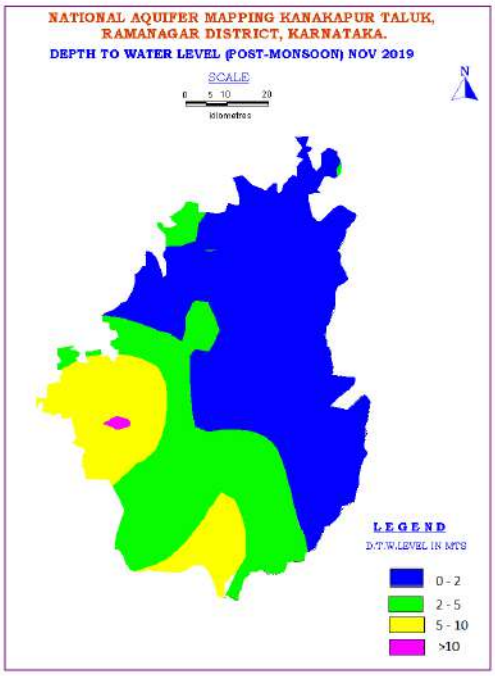
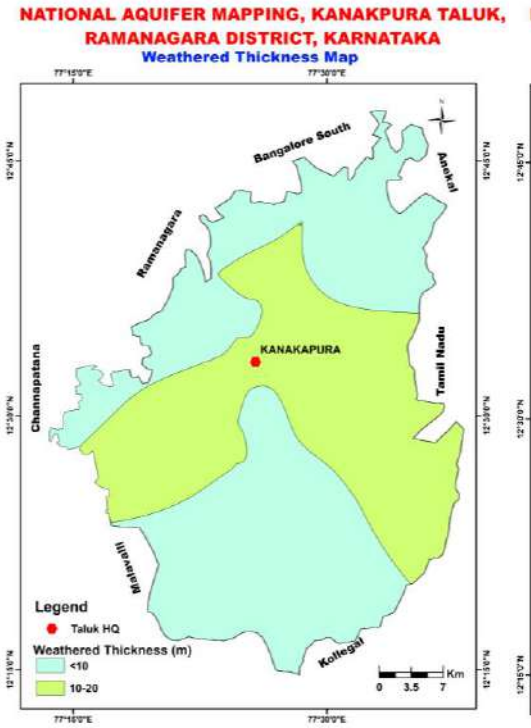


Fig. 9:Pre-monsoon DTW (May 2019)Fig. 10: Post-monsoon DTW (Nov 2019)



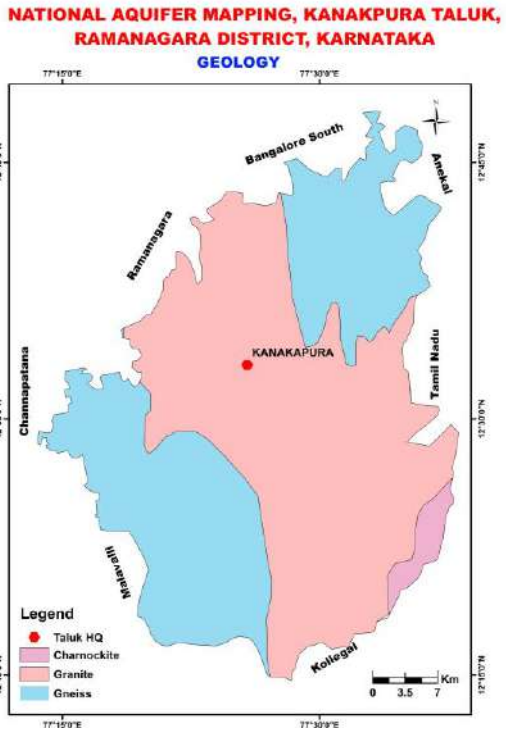


Fig.11: Geology Map **Fig 12: Weathered Thickness Map**

In Kanakapurataluk, fractured Granite and Gneiss are the major water bearing formations **(Fig.11)**. Groundwater occurs within the jointed and fractured Granite and Gneissunder semi-confined to confined conditions. In Kanakapurataluk borewells were drilled

from a minimum depth of 40mbgl to a maximum of 215 mbgl**(Table 8)**. Depth of weathered zone (Aquifer-I) ranges from 3.5mbgl to 18.65mbgl**(Fig.12)**. However, isolated patches in topographical lows are seen yielding seasonally, that too for very short durations. Ground water exploration reveals thatAquifer-II fractured formation was encountered between the depthof 20 to 196 m bgl. Yield ranges from 0.13to 13.5lps. The 2D, 3D aquifer disposition and fence diagram are presented in **Fig-13 a, b & c** respectively.

Table 8:Detailsof Ground water Exploration

S. No.	Location	Latitude	Longitude	Depth Drilled (m bgl)	Casing Depth (m bgl)	Fracture Zones (mbgl)	SWL (mbgl)	Q (lps)	DD (m)
1.	Anajanwadi EW	12°38'16.8''	77°21'57.6''	215	5.6	22, 89, 179, 210	12.02	0.58	-
2.	Hosakote EW	12°41'38.4''	77°28'37.2''	264.65	3.5	20,49	9.47	9.92	8.11
3	Marasandra EW	12°25'51.6''	77°28'58.8''	81.35	5	35, 68.11, 73.73	7.86	6.43	19.53
4	Marasandra OW	12°25'44.4''	77°28'19.2''	81.35	7	28, 66, 70,75,	7.36	4.6	13.46
5	Padavangere EW	12°36'57.6''	77°28'15.6''	100	11.4	27, 35,38.5, 43.25	4.27	8	10.6
6	Padavanagere OW	12°36'28.8''	77°25'12''	40	9	23.5, 28.5, 35	5.3	6.9	8.31
7	TigalaraHosahalli EW	12°29'59.9”	77°25'39.2"	200	6	76, 145.5	24.11	1.78	14.53
8	Harohalli EW	12°41'15.39"	77°28'29.24"	200	23	135, 173	-	1.7	-
9	Horalagallu EW	12°28'38.1˝	77°23'42.2˝	200	14.5	84.5,122, 188, 196	122.60	7.2	-
10	Horalagallu OW	12°28'37˝	77°23'59.8˝	200	18.65	121, 166, 172, 192	118.20	8.04	-
11	Cheelur EW	12°38'38.7"	77°25'12.7"	200	16.1	41	3.63	0.74	26.52
12	Kanakpura EW	12°32'29''	77°25'17.5''	200	24	84.4, 102.65,	10.72	8.04	5.78
13	Kanakpura OW1	12°32'12''	77°25'17.5''	150.45	11.7	78, 109, 149	11.78	13.5	9.54
14	Kanakpura OW2	12°32'04''	77°25'17.5''	119.95	11	75, 111, 114	12.77	8.04	8.06
15	Halsuru EW	12°28'48"	77°31'53"	200	18	72	28.9	0.13	-

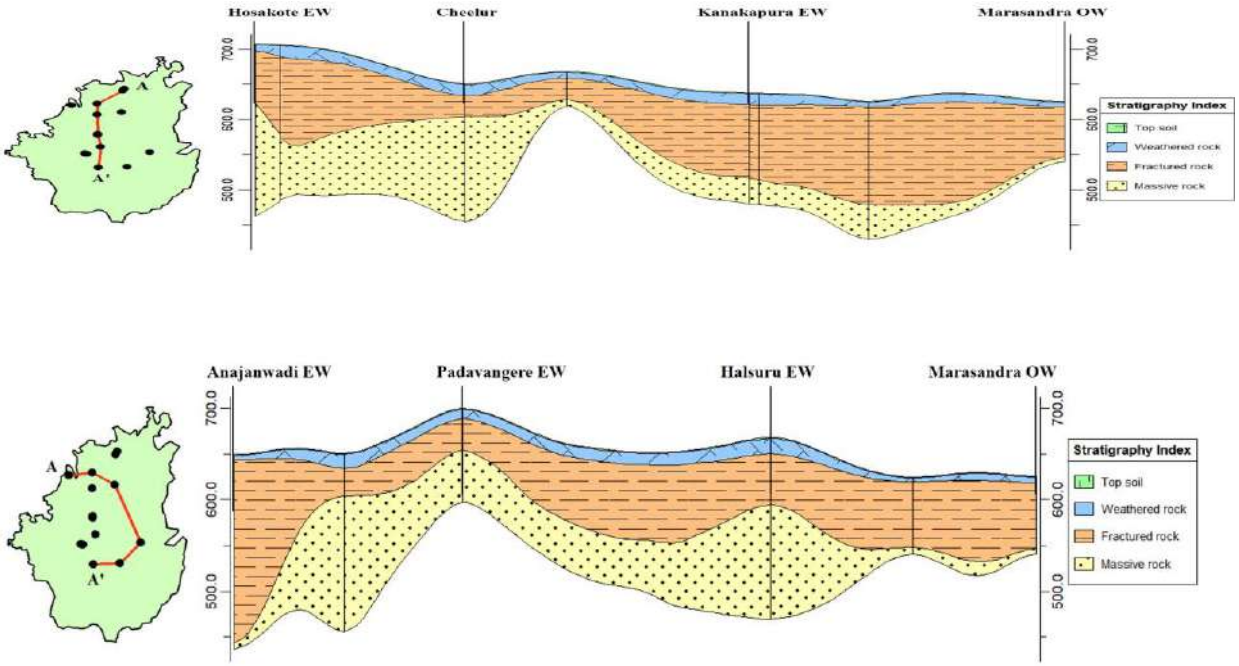


Fig.13a:2-D Aquifer disposition

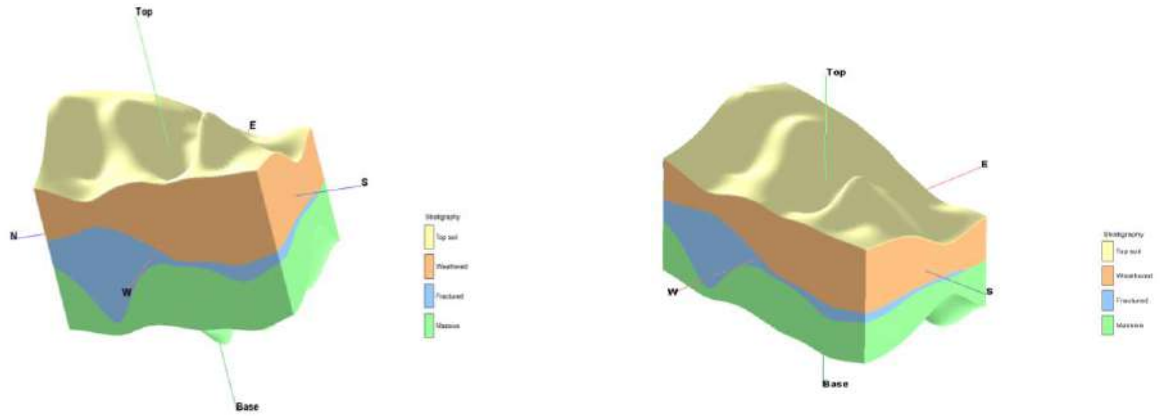


Fig.13b:3D AQUIFER DISPOSITION

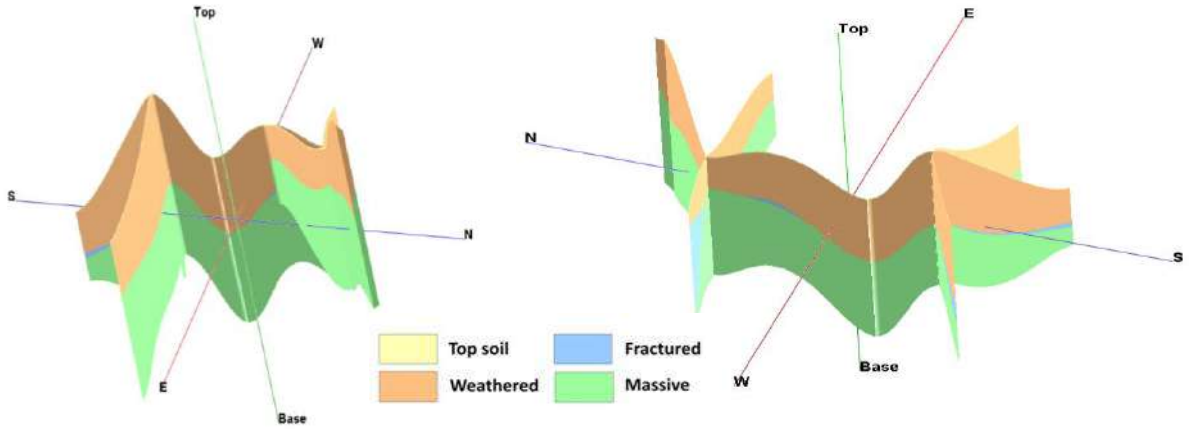


Fig.13c:3D AQUIFER Fence diagram

3 GROUND WATER RESOURCE,EXTRACTION, CONTAMINATIONAND OTHER ISSUES

The main ground water issues are Over Exploitation, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, deeper water levels particularly in Aquifer II in some parts, urbanized areas which are all inter-related or inter dependent along with nitrate contamination in some parts

3.1 Comparison of Ground Water Resource and Extraction

The Dynamic Ground Water Resource 2017 and as on 2020 have already been summarised above and are shown in **Table 9**.It is observed that the ground water availability in 2020 isincreased compared to 2017 due to increase in rainfall and in water table. It is attributable to the improvement in the irrigation practice, influence of command area and also due to the water conservation / recharge activities carried out in the taluk by various state govt. and other agencies.

Table 9: Comparison of groundwater availability and draft scenario (in ham)

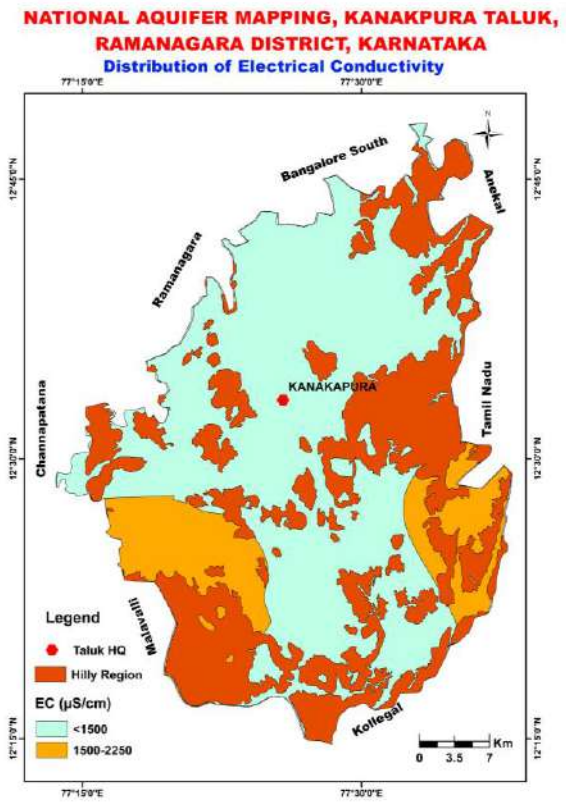
Taluk	March 2017			March 2020		
Kanakpura	GW availability	GW Extraction	Stage of GW development	GW availability	GW Extraction	Stage of GW development
	13462	13694	102%	16191.31	14956.00	92.37%

3.2 Chemical Quality of Ground Water and Contamination

The water samples collected from shallow aquifers of GWMS were collected during pre-monsoon (May 2018) and analysed in the Regional Chemical Laboratory for pH, Electrical Conductivity (EC), Chloride, Nitrate and Fluoride by employing Standard methods. Based on the hydro chemical data, the portability of these samples has been assessed as per the Standards prescribed by the Bureau of Indian Standards (IS 10500: 2012) and categorized into 'Desirable', 'Permissible' and 'Unsuitable' classes.

The electrical conductivity in water samples is an indication of total dissolved ions. Thus the higher the EC, the higher the levels of dissolved ions in the sample. The perusal of the data indicates that the distribution of electrical conductivity in the taluk shows wide variations (738-1740μS/cm at 25˚ C). The BIS has recommended a drinking water standard for total dissolved solids a limit of 500mg/l (corresponding to about EC of 750 μS/cm at 25°C) can be extended to a TDS of 2000mg/l (corresponding to about 3000 μS/cm at 25°C) in case absence of an alternate source. Water samples having TDS more than 2000mg/l are not suitable for drinking purpose. As per map**(Fig.14),** theEC is within 2250 μS/cm at 25°C.

One of the essential elements for maintaining normal development of healthy teeth and bones is Fluoride. Lower concentrations of fluoride usually below 0.6mg/l may contribute to dental caries. Most of the fluoride found ingroundwater is of geogenic origin. Distribution of fluoride in the taluk ranges from 0.22 mg/l to 1.38 mg/l. Thus majority of samples in the taluk shows fluoride concentration within 1.5 mg/l rendering them suitable for drinking purpose**(Fig.15).**



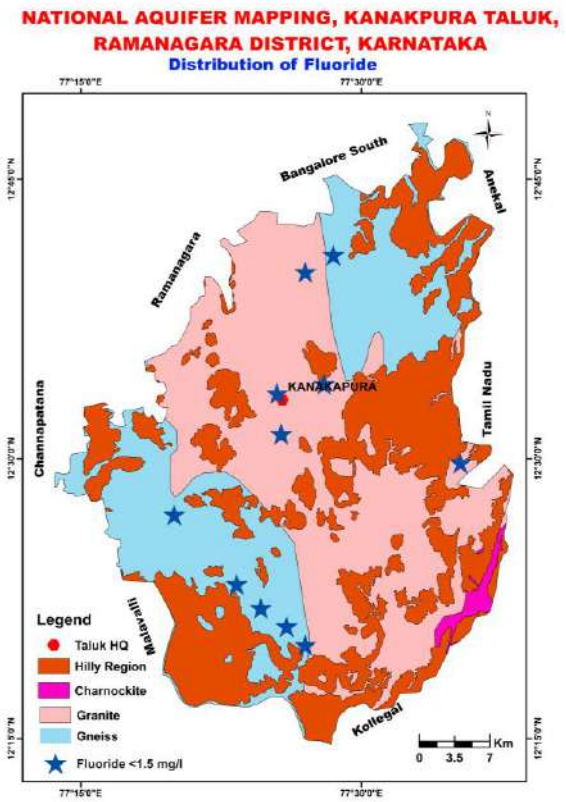


Fig.14: Distribution of EC **Fig.15: Distribution of Fluoride**

Nitrate is a problem as a contaminant in drinking water (primarily from groundwater and wells) due to its harmful biological effects. High concentrations can cause methemoglobinemia, and have been cited as a risk factor in developing gastric, an intestinal cancer. The distribution of nitrate in the taluk indicated that the values are in the range of 1.7 mg/l to 90 mg/l. Nitrate in drinking water should not exceed 45 mg/l as per BIS (ISO: 10500: 2012) standard**(Fig.16)**.Thus majority of the samples collected from the taluk indicates that the ground water is contaminant by nitrate and treated water should be used for drinking purpose

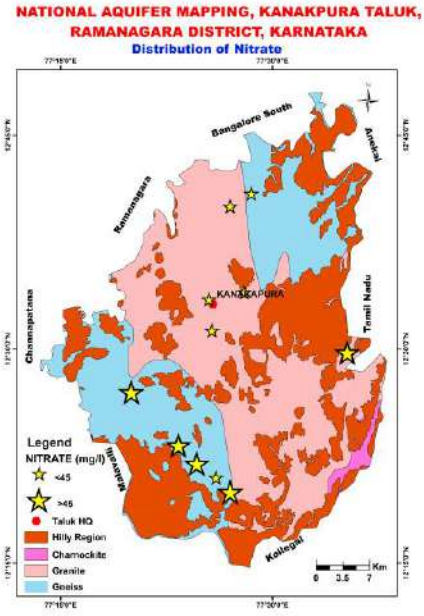


Fig.16: Distribution of Nitrate

4 GROUND WATER RESOURCE ENHANCEMENT

4.1 Resource Enhancement by Supply Side Interventions

Artificial recharge and water conservation measures through construction of artificial recharge structures, viz., percolationtanks &sub surface dykesare proposed in the taluk through utilizingthe uncommitted surfacerunoffof 79.99MCM **(Table 10).** By constructing 72percolationtanksand 2 Subsurface dykes in the taluk, 7200 hectares of additional irrigation potential can be created.

Table-10: Details of Proposed AR structures

Geog. Area	Area feasible for AR	No of proposed AR structures			Availability of surface non committed monsoon runoff. (MCM)	Total cost in lakhs	Expected benefits of artificial recharge and RWH	
		Sub surface dyke	Percolation tank	Check dam			Vol. of water likely to be recharged (MCM)	Additional irrigation potential (Hectares)
1594	1184	2	72	0	79.99	1482.514	15.72	7200

The existing 92% of stage of ground water extraction (2020) would reduce to 84% **(Table 11)**. The representative tentative locations of the proposed artificial recharge structures are given in **Fig.-17**and the locations are given in **Annexure-I.**

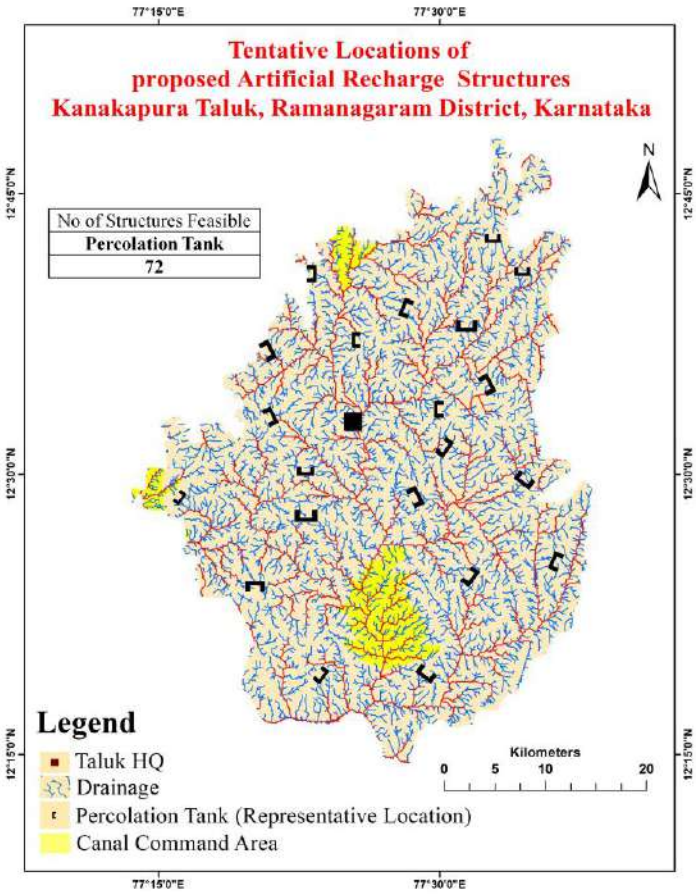


Fig.17: Proposed Artificial Recharge Structures

After implementation of Artificial Recharge structures for GW recharge, the annual ground water availability will increase from 16191 to 17763 ham and the expected improvement in stage of extractionis 8.18% from 92% to 84%.

Table 12: Improvement in GW availability (GWRA 2020)due to Recharge

Taluk	Net annual ground water availability	Existing Ground Water extraction for all uses	Existing Stage of Ground water extraction	Expected recharge from proposed artificial recharge structures	Cumulative annual ground water availability after implementation of AR	Expected improvement in stage of ground water extraction after the implementation of theproject	Expected improvement in stage of ground water extraction
	HAM	HAM	%	HAM	HAM	%	%
Kanakapura	16191	14956	92.37	1572	17763	8.18	84.19

4.2 Resource Savings by Demand Side Interventions

4.2.1 Water Use Efficiency by Micro Irrigation Practices

It is observed that presently, in the command areas, canals are the source of irrigation and in non-command areas, ground water through borewells is used for irrigation purpose in the taluk. Water use efficiency measures have to be adopted for saving the ground water resources.

Efficient irrigation practices like Drip irrigation and sprinkler has to be adopted by the farmers in the existing 15064ha of gross irrigated area. Presently, groundwater extraction for irrigation is 14350ham. It is proposed to adopt micro irrigation (drip) techniques in fruits and vegetables (4935 ha) as well as water intensive sugarcane grown area (241 ha). It is assumed that 50% of this area i.e., 2467 and 120 ha is irrigated by ground water. Implementation of efficient irrigation techniques will contribute in saving ground water by 368ham and thus enhancing the cumulative net availability of ground water from 16191 ham to 16559 ham.Implementation of efficient irrigation techniques will contribute in saving ground water by 368ham. Thus, will improve stage of extractionby 1.7% from 84.1% to 82.4%**(Table 13).**

4.2.2 Grey Water Utilization

As per data 449 ham of domestic grey water is available. It is suggested to put 50% of this grey water to secondary treatment and use the treated water either for irrigation or recharging the tanks and ponds. Thus 225 ham of treated sewage water can be utilized for gainful purposes thereby reducing the load on fresh groundwater. The resource enhancement by grey water use will bring the stage of extraction from 82.4% to 81.4%.

4.2.3 Change in Cropping Pattern

In Kanakapura taluk the water intensive crops grown are paddy and sugarcane. Paddy is grown in an area of 2388 hectares which is 2.7% of the total area and basically for self-consumption, and hence, it may not be possible to change it. Sugarcane is grown in 241hectares which is also in very small area about 0.3% of the total area. The proposed

artificial recharge structures and proposed micro irrigation practices will be able to bring down the stage of extraction from 92 to 82%. Thus change in cropping pattern is not recommended.

Table13:ImprovementinGWavailabilityduetosavingbyadoptingwateruseefficiency and Grey Water

Sl No.	Resource Details	As per 2020 Estimation
1	Cumulative Ground Water availability after implementation of artificial recharge schemes (ham)	17763
2	Existing Ground Water Extraction for all uses in ham	14956
3	Expected improvement in stage of Ground Water extraction after implementation of artificial recharge schemes	84.19%
4	Saving due to adopting Water Use Efficiency measures in ham a. **Fruits & Vegetables** irrigated by GW – 2467 ha, CWR by surface flooding – 0.50m, CWR by drip irrigation – 0.375 m, Savings – 0.125 b. **Sugarcane** irrigated by GW – 241 ha, CWR by surface flooding – 2.00 m, CWR by drip irrigation – 1.50 m, Savings – 0.50	368 ham 308 ham 60 ham
5	Additional saving by adopting Grey Water (50% of Available grey water) in ham	225
6	Cumulative Ground Water Availability after adopting WUE and Grey water in ham	18356
7	Expected improved stage of Ground Water extraction after implementation of all interventions (%)	81.4
8	Total water likely to be saved after all interventions (ham)	2165

4.2.4 RegulationandControl

Kanakapura taluk has been categorized as **Critical**, since the Stage of ground water extractionhas reached **92%** (GEC 2020). Hence, stringent action has to be taken up through Karnataka Ground Water Authority to control ground water exploitation in the taluk**.**Ground water recharge component needs to be made mandatory in the taluk to save the situation from deteriorating further.

5 SUMMARY AND RECOMMENDATIONS

The main ground water issues are over exploitation, limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, deeper water levels particularly in Aquifer II in some parts, semi-urbanized areas which are all inter-related or inter dependent along with nitrate contamination in some parts. The summary of ground water management plan of Kanakpurataluk is given in **Table-14.**

Table 14: Summary of Management plan

Stage of GW Extraction and Category (2020)	92%, Critical
Annual Extractable GW Resource (Ham)	16191
Total Extraction (Ham)	14956
Ground Water Draft for Irrigation (Ham)	14350

Ground Water Resource Enhancement by Supply side Interventions	
No of Proposed AR structures SSD PT CD FB	 2 72 0 0
Expected Additional Recharge to GW due to AR (Ham)	1572
Total Estimated Expenditure (Rs. in Lakhs.)	1482.514
Additional Irrigation Potential that can be created (Ha)**OR**	7200
Change in Stage of GW Extraction (%)	92 to 84
Ground Water Resource Enhancement by Demand side Interventions	
Expected Saving due to adopting WUE measures (ham)	368
Change in Stage of GW Extraction (%)	84 to 82
Expected Saving by adopting Grey water re-use (ham)	225
Change in Stage of GW Extraction (%)	82 to 81
Cumulative Ground Water availability by adopting all interventions (ham)	18356
Change in Stage of GW extraction after adopting all interventions, %	92 to 81
Total water likely to be saved after all interventions (ham)	2165
Excess Nitrate concentration	In limited places especially in shallow aquifer Dilution of nitrate rich ground water through artificial recharge, water conservation and Roof top rain water harvesting Improving quality by controlling usage of Nitrogenous fertilizers in agriculture field and maintaining the proper domestic drainage network system

As per the resource estimation – 2020, Kanakapurataluk falls under Critical category with the stage of ground water extraction is 92.37%. However, there is need to formulate management strategy to tackle the over exploitation, water scarcityrelated issues and nitrate contamination in the taluk. It is suggested to adopt ascientific and multi-pronged ground water management strategy covering supply side and demand side interventions aspects as mentioned in the management plan suggested above.

Ground water resource enhancement by supply side interventions: Quantity of surface water available through non-committed surface run-off is estimated to be 79.99MCM. This can be used to recharge the aquifer mainly through percolation tanks (72), and sub surface dyke structures (2).The volume of water expected to be conserved/recharged is 1572ham through these AR structures considering unit recharge of . The approximate cost estimate for construction of these AR structures is Rs. 1482.5lakhs. However, the figures given are tentative and pre-fieldstudies / DPR are recommended prior to implementation of these recharge structures.

Ground water resource enhancement by demand side interventions:At present about 59% of irrigation is by bore wells (ground water). It is proposed to adopt micro irrigation (drip) techniques in fruits and vegetables (4935 ha) as well as water intensive sugarcane grown area (241 ha). It is assumed that 50% of this area i.e., 2467 and 120 ha is

irrigated by ground water. Implementation of efficient irrigation techniques will contribute in saving ground water by 368ham and thus enhancing the cumulative net availability of ground water from 16191 ham to 16559 ham.Implementation of efficient irrigation techniques will contribute in saving ground water by 368ham.

Grey water utilization: As per data 449 ham of domestic grey water is available. It is suggested to put 50% of this grey water to secondary treatment and use the treated water either for irrigation or recharging the tanks and ponds. Thus 225 ham of treated sewage water can be utilized for gainful purposes thereby reducing the load on fresh groundwater.

Annexure-I:Tentative Locations of Proposed Percolation tanks,Kanakapura Taluk, RamanagaraDistrict

S. No	Longitude	Latitude	Village	Grama Panchayat	Taluk
1	77.46514026	12.27644276	Mugguru State Forest	Bannimukkodlu	Kanakpura
2	77.52087543	12.2813228	Mugguru State Forest	Bannimukkodlu	Kanakpura
3	77.46642448	12.30546614	Mugguru State Forest	Bannimukkodlu	Kanakpura
4	77.34242778	12.31765467	Cheelandavadi State Forest	Uyyamballi	Kanakpura
5	77.39450812	12.31779466	Cheelandavadi State Forest	Uyyamballi	Kanakpura
6	77.56710738	12.31933573	Honnaganahalli	Bannimukkodlu	Kanakpura
7	77.42378835	12.32087679	Cheelandavadi State Forest	Uyyamballi	Kanakpura
8	77.48671516	12.32190417	Mugguru State Forest	Bannimukkodlu	Kanakpura
9	77.53679977	12.32601368	Mugguru State Forest	Bannimukkodlu	Kanakpura
10	77.5026395	12.33859904	Mugguru State Forest	Bannimukkodlu	Kanakpura
11	77.38937123	12.34733174	Cheelandavadi State Forest	Uyyamballi	Kanakpura
12	77.35362104	12.35756108	Hulya	Uyyamballi	Kanakpura
13	77.53166289	12.36068763	Irlapodu	Bannimukkodlu	Kanakpura
14	77.48851307	12.38996787	S.I.Chikkakoppa	Hukundha	Kanakpura
15	77.55477886	12.39150893	Salbanni	Hosadurga	Kanakpura
16	77.29647577	12.39604636	Harihara	Honniganahalli	Kanakpura
17	77.50751954	12.39895741	Channasandra	Hukundha	Kanakpura
18	77.33521956	12.40101299	Dunthuru	Kadahalli	Kanakpura
19	77.526526	12.4082038	Kempalanattha	Hosadurga	Kanakpura
20	77.35573586	12.40841231	Cheelandavadi State Forest	Uyyamballi	Kanakpura
21	77.57532395	12.41761011	Hosadurga	Hosadurga	Kanakpura
22	77.60093847	12.42172672	Biladala	Kolagondanahalli	Kanakpura
23	77.38745403	12.43107542	NayakanahalliMajarePuradoddi	Achalu	Kanakpura
24	77.33151989	12.44776325	Sathanur	Sathanuru	Kanakpura
25	77.53097589	12.44956298	K.G.Thattaguppe	Herindyapanahalli	Kanakpura
26	77.61562947	12.4534551	Kolagondanahalli	Kolagondanahalli	Kanakpura
27	77.42401143	12.45448991	Koonuru	Narayanapura	Kanakpura
28	77.38297882	12.4605439	Acchalu	Achalu	Kanakpura
29	77.4733233	12.4606059	Koothagala	Mullahalli	Kanakpura
30	77.57532395	12.46838173	Bilikallu State Forest	Chakanahalli	Kanakpura
31	77.31234892	12.47635154	Anumanahalli	ArekatteDoddi	Kanakpura
32	77.48018433	12.47935938	Chikkabettahalli	Narayanapura	Kanakpura
33	77.26963465	12.47971487	Kabbalu State Forest	Kabbal	Kanakpura
34	77.45058172	12.49182285	Narayanapura	Narayanapura	Kanakpura
35	77.57401587	12.49585885	Bilikallu State Forest	Chakanahalli	Kanakpura
36	77.38163349	12.50325817	Sheegekote	Shivanahalli	Kanakpura
37	77.35972269	12.50794476	Gerahalli	Choodahalli	Kanakpura
38	77.55189603	12.51329642	Bilikallu State Forest	Chakanahalli	Kanakpura
39	77.41324877	12.51839315	Aralalu	Shivanahalli	Kanakpura
40	77.30999459	12.51973848	Kempasagara	Kabbal	Kanakpura
41	77.50540397	12.52209281	Sudagatta	Chakanahalli	Kanakpura
42	77.54576391	12.54126378	Bilikallu State Forest	Chakanahalli	Kanakpura

S. No	Longitude	Latitude	Village	Grama Panchayat	Taluk
43	77.41204909	12.5416446	Kanakapura		Kanakpura
44	77.45653913	12.54491988	Virapasandra	Chakanahalli	Kanakpura
45	77.33824655	12.54496344	Choodahalli	Choodahalli	Kanakpura
46	77.37490683	12.55236276	BananthiMaristate Forest	Somandayapanahalli	Kanakpura
47	77.35069087	12.55337176	Kuthagondanahalli	Somandayapanahalli	Kanakpura
48	77.55888089	12.55875309	Therubeedhi	Chakanahalli	Kanakpura
49	77.49800465	12.56077109	J.I.Bachahalli	Chakanahalli	Kanakpura
50	77.37894282	12.57691506	BananthiMaristate Forest	Somandayapanahalli	Kanakpura
51	77.54610025	12.58196005	Bilikallu State Forest	Chakanahalli	Kanakpura
52	77.51346136	12.58967924	Devarahalli	Doddamaralawadi	Kanakpura
53	77.58376953	12.58969571	Yelachavadi	Yalachavadi	Kanakpura
54	77.45562671	12.5967587	Rayasandra	Thungani	Kanakpura
55	77.33555589	12.59944936	Byalalu	Chikkamudhuvadi	Kanakpura
56	77.34867287	12.61155735	DoddakallubaluMajareWadedoddi	Hallimaranahalli	Kanakpura
57	77.42502042	12.61895667	Ramapura	Thungani	Kanakpura
58	77.52322961	12.63173732	Chikkamaralavadi	Doddamaralawadi	Kanakpura
59	77.43981907	12.63711864	Jakkasandra	Cheeluru	Kanakpura
60	77.57468854	12.64350897	Kallanakuppe	Yalachavadi	Kanakpura
61	77.47008903	12.64922662	Doddasadhenahalli	T.Hosahalli	Kanakpura
62	77.39280569	12.65049359	Bilaguli	Kottagalu	Kanakpura
63	77.49740637	12.65098011	Avaremala	Dyavasandra	Kanakpura
64	77.44875489	12.67676539	Harohalli	Harohalli	Kanakpura
65	77.38733172	12.67787186	Picchanakere	Kottagalu	Kanakpura
66	77.57232965	12.67822493	Thattekere	Banavasi	Kanakpura
67	77.50069531	12.6889139	Marasandra	Harohalli	Kanakpura
68	77.54610025	12.70875754	Gulattekaval	Kaggalahalli	Kanakpura
69	77.60395311	12.70936188	Thattekere	Banavasi	Kanakpura
70	77.49531399	12.72221085	Kaggalahalli	Kaggalahalli	Kanakpura
71	77.53802826	12.72624684	Gulattekaval	Kaggalahalli	Kanakpura
72	77.58108692	12.76628411	Ragihalli State Forest	Dyavasandra	Kanakpura