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

Krishnarajanagara Taluk, Mysore District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु

South Western Region, Bengaluru

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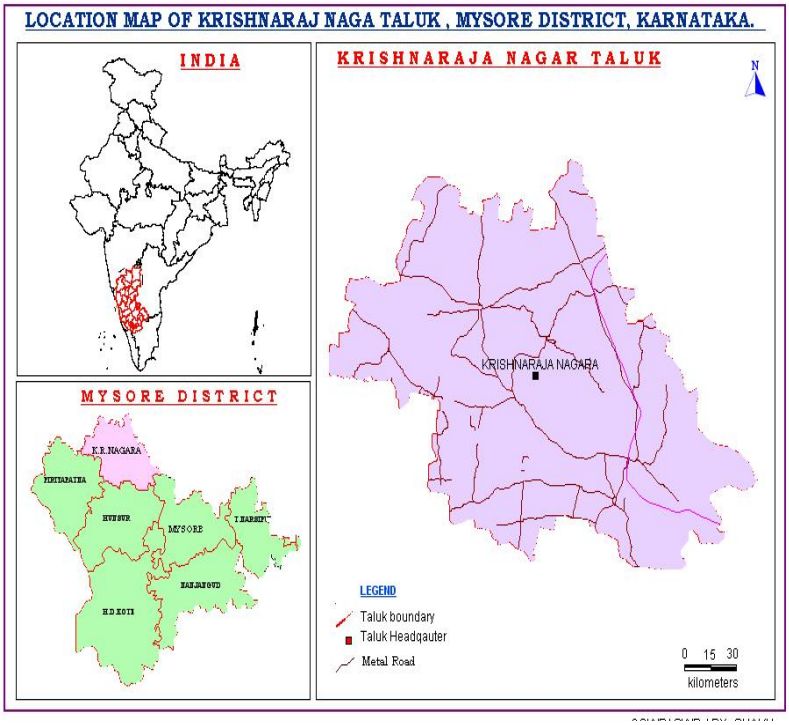
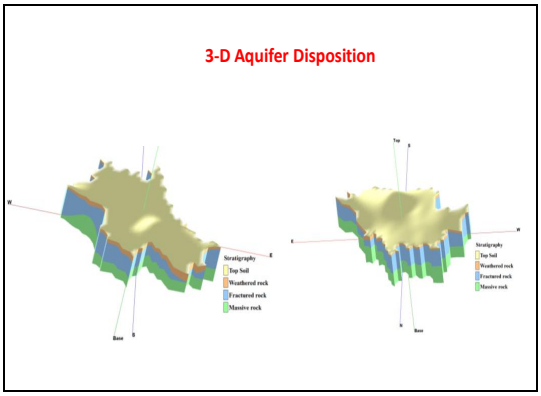
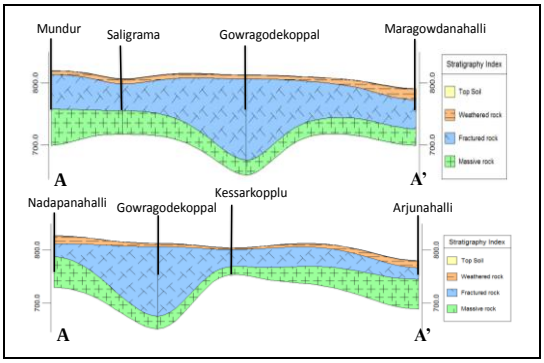
AQUIFER MAPS AND MANAGEMENT PLAN, KRISHNARAJA NAGARA TALUK, MYSURU DISTRICT, KARNATAKA STATE

(AAP: – 2021-2022)







By

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AUGUST 2022

AQUIFER MAPS AND MANAGEMENT PLAN, KRISHNARAJANAGARA TALUK, MYSURU DISTRICT, KARNATAKA STATE

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AQUIFER MAPS AND MANAGEMENT PLAN, KRISHNARAJA NAGARA TALUK, MYSURU DISTRICT, KARNATAKA STATE

1 SALIENT FEATURES

Name of the Taluk: KRISHNARAJA NAGARA

District: Mysuru

State: Karnataka

Area: 608 Sq.Kms.

Population: 2,52,657

Annual Normal Rainfall: 735 mm

1.1 Study area

Aquifer Mapping Studies have been carried out in Krishnaraja Nagar taluk, Mysore district of Karnataka, covering an area of 608 sq.kms under National Aquifer Mapping Project. The Krishnaraja Nagara taluk is located between North Latitudes 12°37'42.79'' and 12°23'56.36" and East Longitudes between 76° 24' 48.43" to 76°8'12.81". The taluk is covered part of survey of India toposheet Nos. 57D/2,57 D/3 , 57D/4, 57 D/8 and 57D/11. The study area is bounded on the East by Mandya district, on the South by Hunsur Taluk of Mysore district, on the North by Hasan district, on the West by Piriyapatna Taluk of Mysore district. Location map of Krishnaraja Nagara taluk of Mysore district is presented in **Fig-1**. Krishnaraja Nagara is taluk headquarter. There are 179 villages and 34 Grampanchayats in this taluk.

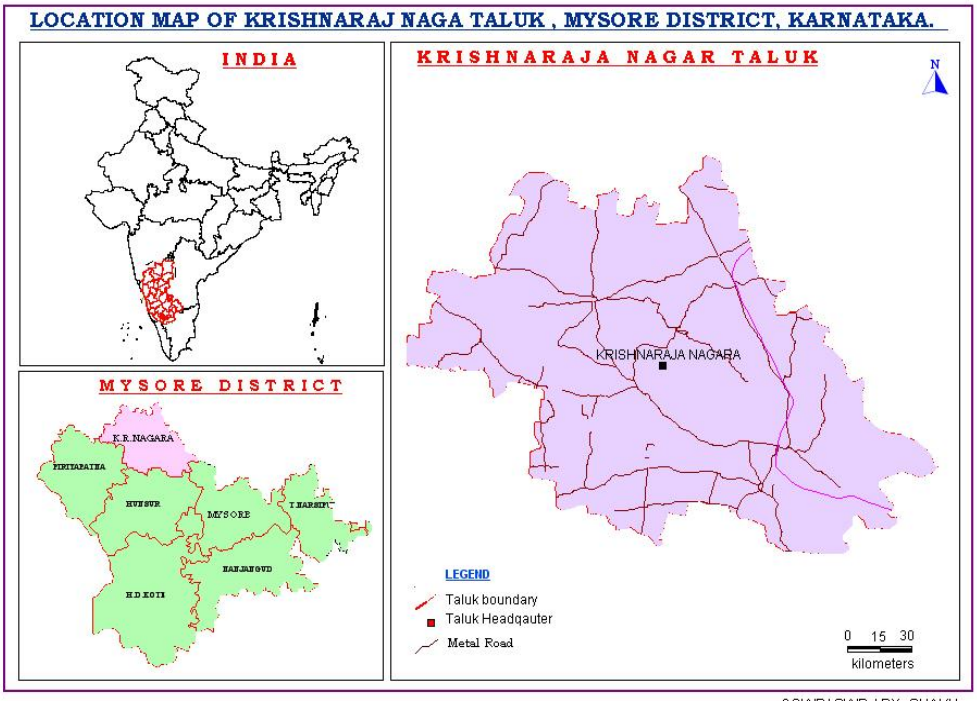

Fig. 1: Location Map

1.2 Population

According to 2011 census, the population in Krishnaraja Nagara taluk is 2,52,657, in which 1,26,539 male population and 1,26,118 is the female population . The taluk has an overall population density of 416 persons per Sq.Kms. The decadal variation in population from 2001-2011 is 5.62% in Krishnaraja Nagara taluk.

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
2,52,657	1,26,539	1,26,118	8.42	2,16,852	35,805	5.62	3.97	16.88

Source: District at a glance 2020-21, Govt. of Karnataka

1.3 Rainfall

Krishnaraja Nagara taluk enjoys semi-arid climate. The area falls under Southern Dry Agro-climatic zone of Karnataka State.The normal annual rainfall in Krishnaraja Nagara taluk for the period 1961 to 2010 is 735 mm. Seasonal rainfall pattern indicates that, major amount of (317 mm) rainfall was recorded during South-West Monsoon seasons, which contributes about 45% of the annual normal rainfall, followed by North-East Monsoon season (233 mm) constituting 33% and remaining (157 mm) 22% in Pre-Monsoon season. The coefficient of variation percent for pre-monsoon, monsoon and post-monsoon season is 62, 26 & 43 percent respectively. Annual Co-efficient Variation at this station works out to be 20 percent.

Table-2 Actual Annual rainfall (mm) in rain gauge station from 2010 to 2020

Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**20017**	**2018**	**2019**	**2020**
Rainfall (mm)	848	743	395	603	882	899	405	872	793	783	706

Source: District at a glance 2020-21, Govt. of Karnataka

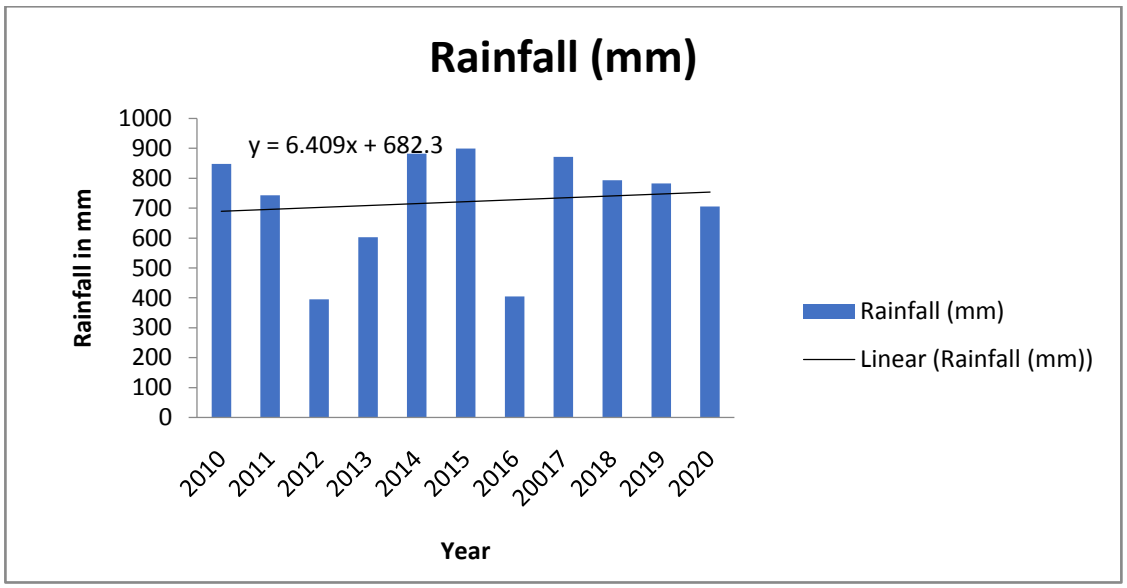

Fig. 2: Rainfall Trend Analysis

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Krishnaraja Nagara taluk. Major Kharif crops are Paddy, Maize, ragi and Vegetables. Important crops of Rabi season are maize, vegetable and oilseeds. Water intensive crops like Paddy and Tobacco are grown in Krishnaraja Nagara Taluk **(Table.3).**

Table-3: Cropping pattern in Krishnaraja Nagara taluk as per 2019-2020 (Ha)

Crops	**Cereals (Area in Ha)**				**Pulses (Area in Ha)**						
	Paddy	Jowar	Ragi	Maize	Tur	Horse gram	Black gram	Green gram	Avare	Cowpea	Bengal gram
	20,952	523	9,457	2,390	203	7,812	570	211	1,787	3,024	98
Total	**33,322**				**13,705**						
Total Food grains – 52,593											

Fruits (Area in Ha)	**Veg (Area in Ha)**	**Oil seeds (Area in Ha)**				**Commercial crops (Ha)**		
		Groundnuts	Nigerseed + Musturd	Castor	Sesame	Cotton	Sugarcane	Tobacco
1,180	**1,451**	63	15	1	467	11	1,067	12,943
		Total Oil seeds – 546				**Total – 14,021**		

Source: District at a Glance 2020-21, Govt. of Karnataka

It is observed that net sown area accounts 41,361 (Ha) and area sown more than once is 31,694 (Ha) of total geographical area 61,976 (Ha) in Krishnaraja Nagara taluk **(Table-4).** Area under Forest is 166 (Ha) Area not available for cultivation and Fallow land cover 12,456 (Ha) and 5,230 (Ha) of

total geographical area respectively. 20,680 (Ha) of net area is irrigated from surface water 20,680 Ha and 8,210 (Ha) are irrigated from Groundwater **(Table-5).**

Table-4: Details of land use in Krishnaraja Nagara taluk as per 2019-2020 (Ha)

Total Geographical 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
61,976	166	12,456	2,764	5,230	41,361	31,694	73,055

Source: District at a Glance 2020-21, Govt. of Karnataka

Table-5: Irrigation details in Krishnaraja Nagara taluk as per 2019-2020 (Ha)

Sl.No	Source		Length in Km/No of structures	Gross area irrigated	Net area irrigated
1	Surface water	Canals	293	26,135	19,800
		Tanks	158	1,715	880
		Lift irrigation	0	0	0
		Total		**27,850**	**20,680**
2	Ground water	Dug wells	202	2,610	1,300
		Bore wells	7,313	7,476	6,910
		Total		**10,086**	**8,210**
Grand Total				**37,936**	**28,890**

Source: District at a Glance 2020-21, Govt. of Karnataka

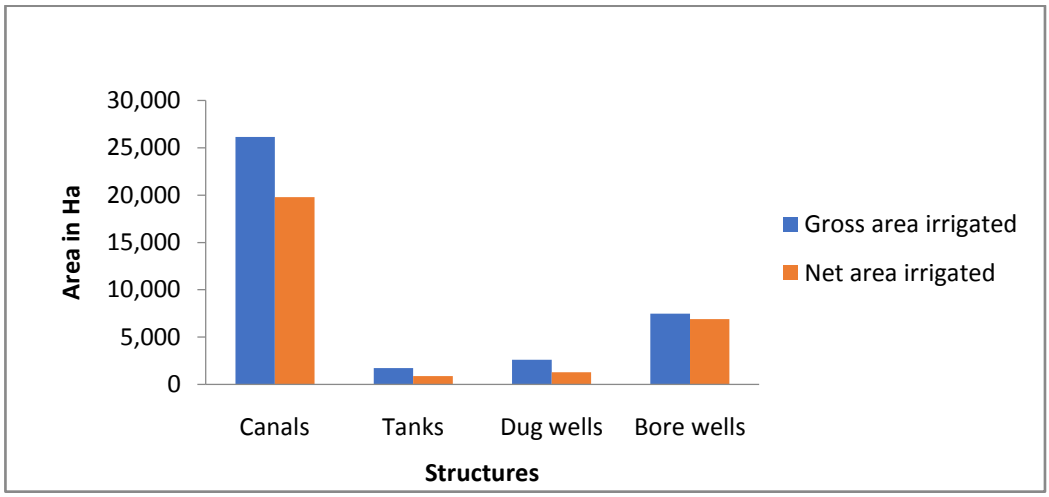

Fig. 3: Sources of Irrigation

1.5 Geomorphology, Physiography & Drainage

The geomorphology of the Krishnaraja Nagara is formed by various land forms like hills and plateaus, piedmont zone, plains and river/stream, etc. plain region and covered all parts of the taluk. The elevation in the taluk varies from 869 m in the Northern part to 751m amsl in the Eastern part of the taluk. This has its bearing on the regional slope which is towards East. The drainage system is well developed in the taluk. The differential altitude is significant because, it is likely to cause irregular ground water flow patterns on the micro scale **(Fig.-4).** Topography is dominantly controlled by geological structures. The entire Krishnaraja Nagara taluk falls in Cauvery river basin. The Drainage pattern is dendritic to subdendritic **(Fig.-5).**

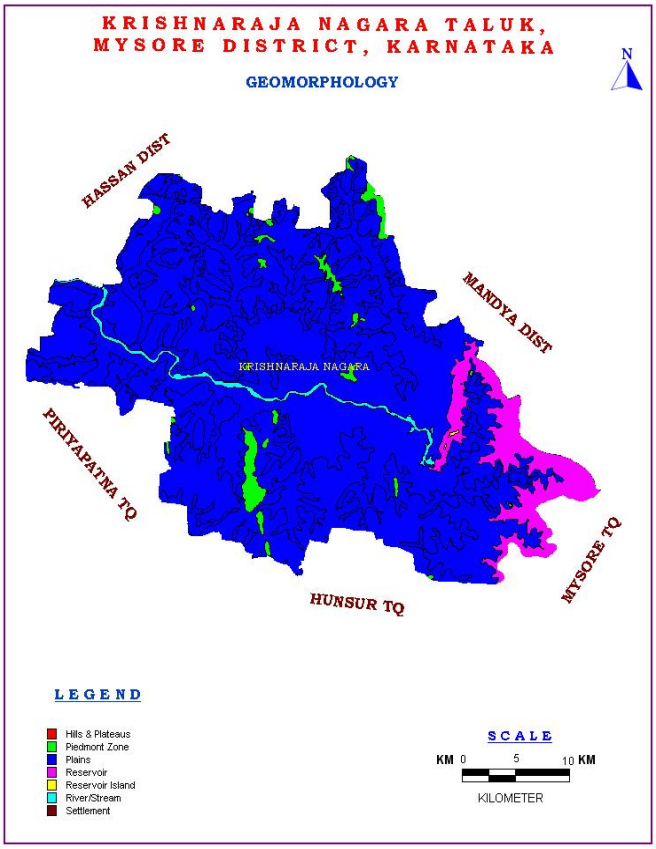

Fig-4: Geomorphology Map

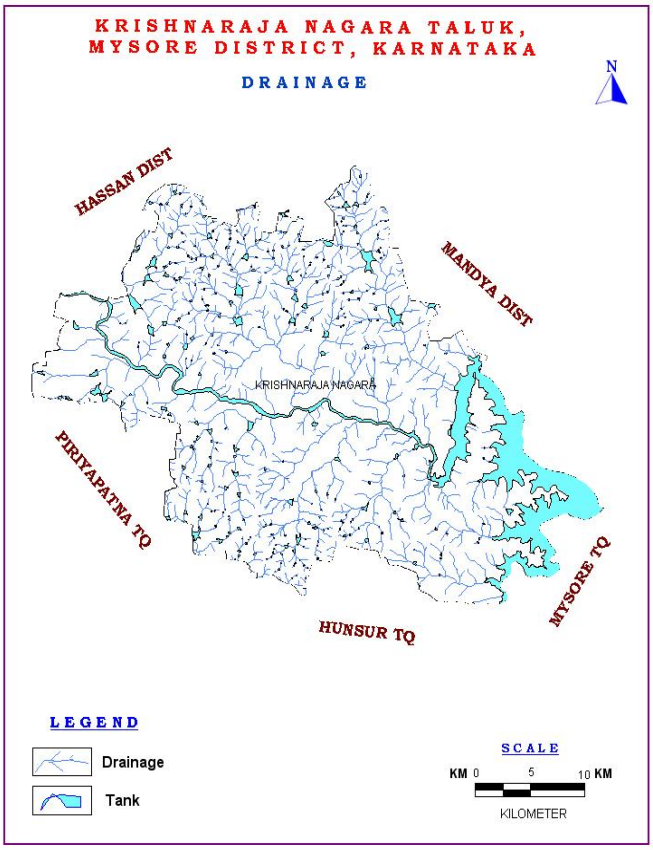

Fig-5: Drainage Map

1.6 Geology, Soil and Landuse

Geologically, the taluk is mainly composed of igneous and metamorphic rocks of Pre-Cambrian age either exposed at the surface or covered with a thin mantle of residual and transported soils. The rock formation in the taluk falls into gneissic complex formation. The geology map has been given in **Fig. 6.**

The soils of Krishnaraja Nagara taluk can broadly be classified into Clayey soils and Clayey Skeletal soils and Loamy soils. These soils vary in depth and texture, depending on the parent rock type, physiographic settings and climatic conditions **(Fig-7)** and mainly this taluk covered by agricultural land. Land Use and Land Cover map also included **(Fig.8).**

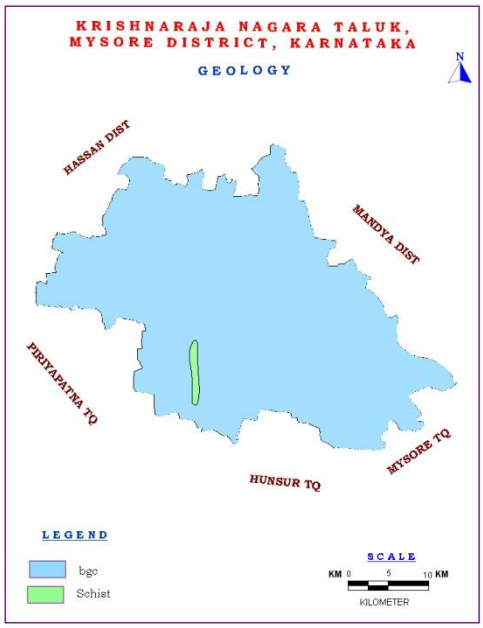

Fig-6: Geology Map

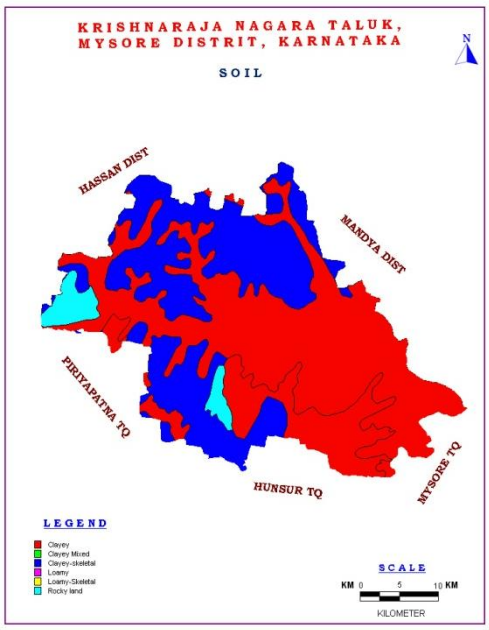

Fig-7: Soil Map

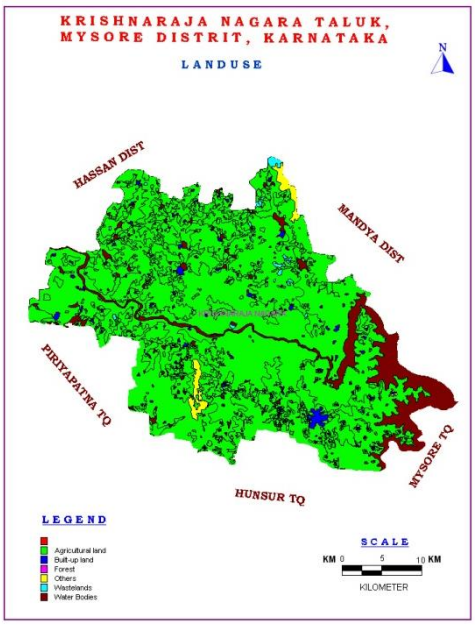

Fig-8: Land use Map

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 13,733ham. The existing gross groundwater for irrigation Domestic and Industrial is 3,465ham. The stage of groundwater development is 25.22% and falling under 'Safe' category.

Table-6a. Detail of Dynamic Ground Water resource, (March 2017 Ham)

Annual Extractable GW Resource (Ham)	GW Extraction for Irrigation Use (Ham)	GW Extraction for Domestic and Industrial Use (Ham)	Total Extraction (Ham)	Annual GW Allocation for Domestic and Industrial Use for next 25Yaers (Ham)	Net GW Availability for future Irrigation Development (Ham)	Stage of GW Extraction (%)	Categorization
13,733	3,174	290	3,465	655	10,007	25.22	Safe

Aquifer-wise total ground water resources down to 150 m depth are given in **Table-6b** below as per 2020 estimations.

Table-6b: Total Ground Water Resources (2020) (Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
Krishnaraja Nagara	15777.45	Phreatic	Fractured (Down to 150m)	Dynamic + phreatic in-storage + fractured
		3872	1085	20734.45

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

As per the GWRA 2017, the net ground water availability is 13,733 ham and the total ground water draft for all uses is 3,465 ham with stage of development at 25.22% and the taluk falls in Safe category. The domestic (Industrial sector) demand for next 25 years is estimated at 655 Ham.

The details of dynamic (Phreatic) ground water resources for Krishnaraja Nagara taluk as on March 2020 is shown in Table-7**.** It is observed that the stage of ground water extraction is all most same as 2017 to 2020 like 25.22%to 24.55%.

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 Domestic Use as on 2025 (Ham)	Net GW Availability for future use (Ham)	Stage of GW Extraction (%)	Categorization
15,777.44	3,289.88	0	583.02	3,872.91	719.67	11897.24	24.55	Safe

1.9 Water level behavior

The water level data have been monitored from the representative dug wells and borewells under NHS monitoring programme for both pre and post monsoon seasons during 2019 in Aquifer I and Aquifer II (Table 8 and 9). During Pre Monsoon season water level ranges from 2.69 to 13.64 mbgl, whereas in Post Monsoon it varies from 1.89 to 7.13 mbgl. Whereas in Aquifer II, the water level ranges from 2.41 to 17.81 mbgl in Pre Monsoon and 1.23 to 10.98 mbgl during Post Monsoon as per Ground water Department, Govt of Karnataka data. (Table 9) and the maps shown in **Fig 9 & 10**.

Table 8: Depth to water level of Pre and Post-monsoon (2019), CGWB

Sl.No.	Site_type	Location name	May-19	Nov-19
1	Dug well	Bheerya A	5.65	1.89
2	Dug well	Gargeswari	12.75	6.35
3	Dug well	Mayagowdanahalli	6.1	5.76
4	Dug well	Chunchanakatte	3.15	6.35
5	Dug well	Salgrama1	2.69	2.95
6	Dug well	Badakanakoppalu	6.7	4.8
7	Dug well	Chamundibetta	9.87	3.94
8	Bore well	Krishnarajanagar	13.64	7.13
9	Bore well	Saligrama	6.08	4.0

Table 9: Depth to water level of Pre and Post-monsoon (2019)

(Ground Water Dept., Govt. of Karnataka)

Sl No	Site_type	Location name	May-19	Nov-19
1	Bore well	Bheerya	17.81	10.98
2	Bore well	Chunchanakatte	2.49	1.23
3	Bore well	Haradanahalli	17.2	6.46
4	Bore well	Krishnarajanagar	12.55	8.2
5	Bore well	Malali	16.25	7.19
6	Bore well	Thandre	5.13	4.87

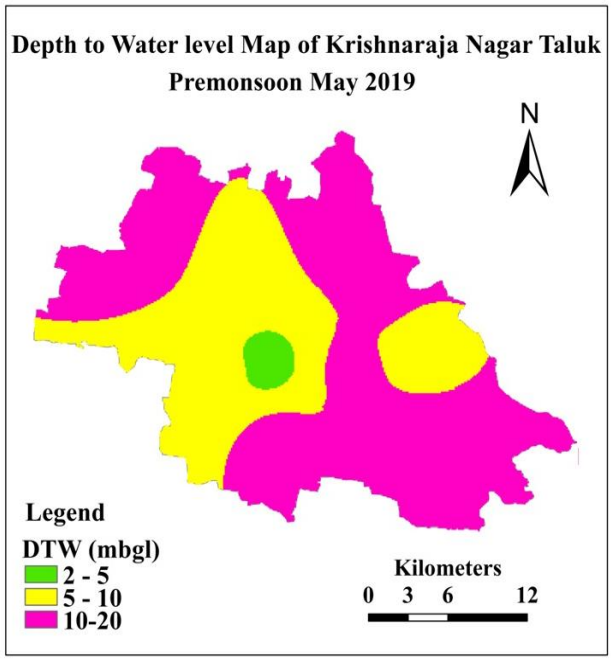

Fig-9: Pre-monsoon Depth to Water Level

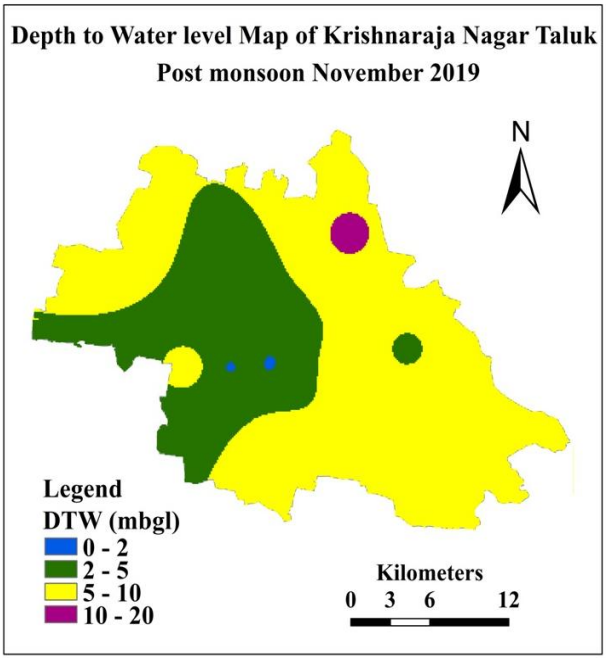

Fig-10: Post-monsoon Depth to Water Level

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 Gneisses 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 Krishnaraja Nagara taluk, there are mainly two types of aquifer systems

- Aquifer-I (Phreatic aquifer) comprising weathered Gneisses.
- Aquifer-II (Fractured aquifer) comprising fractured Gneisses.

In Krishnaraja Nagar taluk Granite gneiss and Schist are the main water bearing formations. Ground water occurs within the weathered and fractured Granitic gneiss under water table condition and semi-confined condition. In Krishnaraja Nagar taluk bore wells were drilled from a minimum depth of 45 mbgl to a maximum of 167.00 mbgl. Depth of weathered zone ranges from 3 mbgl to 24 mbgl. Ground water exploration reveals that aquifer-II fractured formation was encountered between the depths of 18 to 143.0 mbgl. Yield ranges from Negligible to 3.0 lps. The basic characteristics of each aquifer are summarized in Table-10a and 10b.

The 3D aquifer disposition models, 2D aquifer sections and 3D aquifer fence diagrams have been prepared and presented in Fig. 11a, b and c.

Table-10a: Details of Groundwater Exploration

Sl. No	Location	Latitude	Longitude	Depth m bgl	Casing (m)	Lithology	SWL (mbgl)	Q (lps)	T (m^2/day)
1	Saligrama EW	12.5638	76.25778	87.95	7.65	Granitic Gneiss	3.27	3.00	-
2	Saligrama-OW	12.5638	76.25778	48.35	8.2	Granitic Gneiss	3.57	0.3	-
3	Bherya EW	12.5875	76.33472	90	4.6	Granitic Gneiss	9.22	0.43	4.0
4	K.R Nagar-EW	12.43333	76.37917	90	6.1	Granitic Gneiss	9.08	< 1	13.0

Table-10b: Details of Bore well inventory data

Sl. No	Location	Latitude	Longitude	Depth (m bgl)	Casing (m)	Lithology	Fracture (m)	Q (lps)
1	Honnenahalli	12.36876	76.28997	79	6	Granite Gneiss	39	0.8
2	Maragowdanahalli	12.41742	76.29850	91	18	Granite Gneiss	64	0.8
3	Hebbalu	12.46670	76.34593	60	6	Granite Gneiss	18	2.23
4	Kessarkopplu	12.48950	76.29507	45	3	Granite Gneiss	30	1..41
5	Gowregowdakoppal	12.49826	76.25894	167	6	Granite Gneiss	143	0.81
6	Kempegowdakopplu	12.51168	76.20804	97	15	Granite Gneiss	37	0.81
7	Mundur	12.60133	76.25989	121	6	Granite Gneiss	60	0.81
8	Hardanahalli	12.59578	76.21972	91	6	Granite Gneiss	85	0.03
9	Arunahalli	12.52454	76.38296	91	13	Granite Gneiss	33	1.41
10	Dornhalli	12.41553	76.41769	54	24	Granite Gneiss	25	1.41

Table-11: Basic characteristics of each aquifer

Aquifers	Weathered Zone (Aq.-I)	Fractured Zone (Aq.-II)
Prominent Lithology	Weathered Granitic gneiss	Fractured Granitic gneiss
Thickness range (mbgl)	3-24	Fractures upto 143 mbgl
Depth range of occurrence of fractures (mbgl)	-	18-143
Range of yield potential (lps)	-	<1 – 3
T (m^2/day)	-	4 – 13

2.2 3D Aquifer disposition, Aquifer Fence Diagram and 2D Cross-Sections

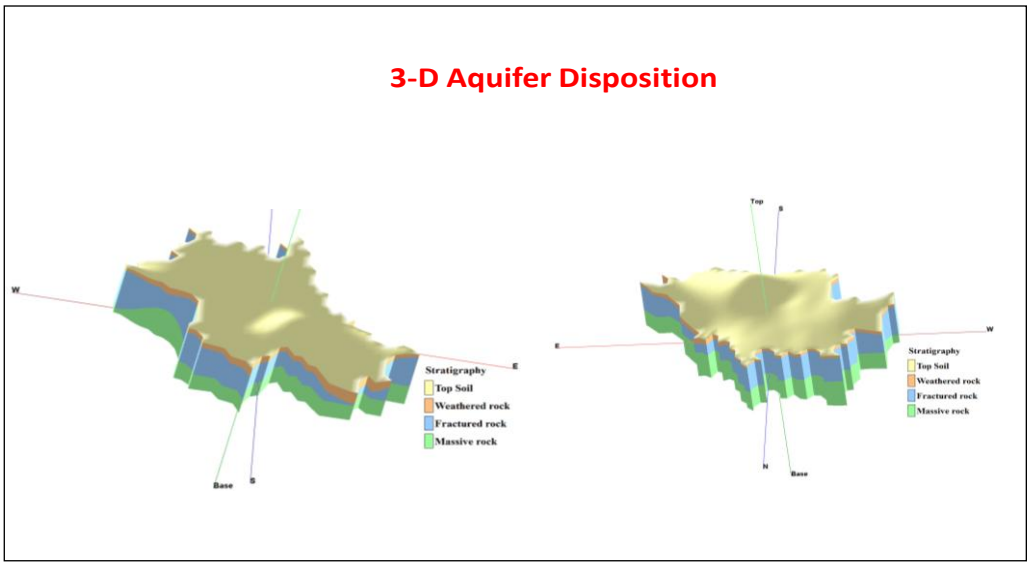

Fig-11a: 3D Aquifer Dispositions

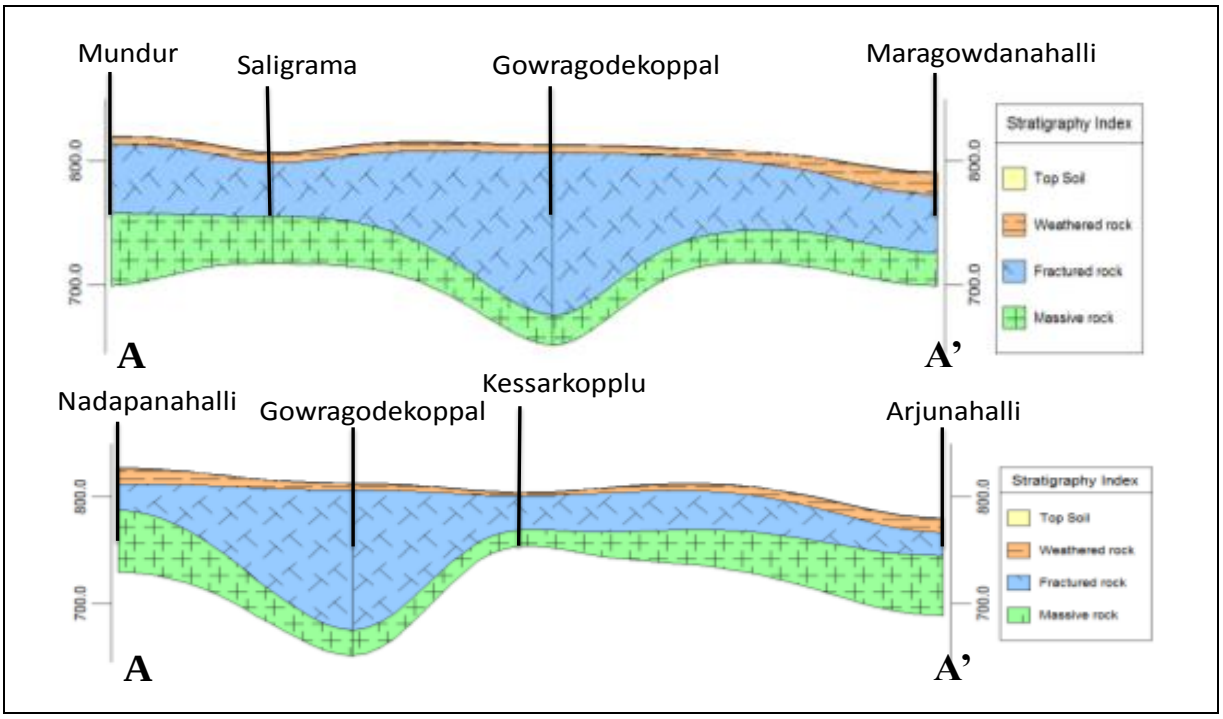

Fig-11b: 2D Cross sections in different directions

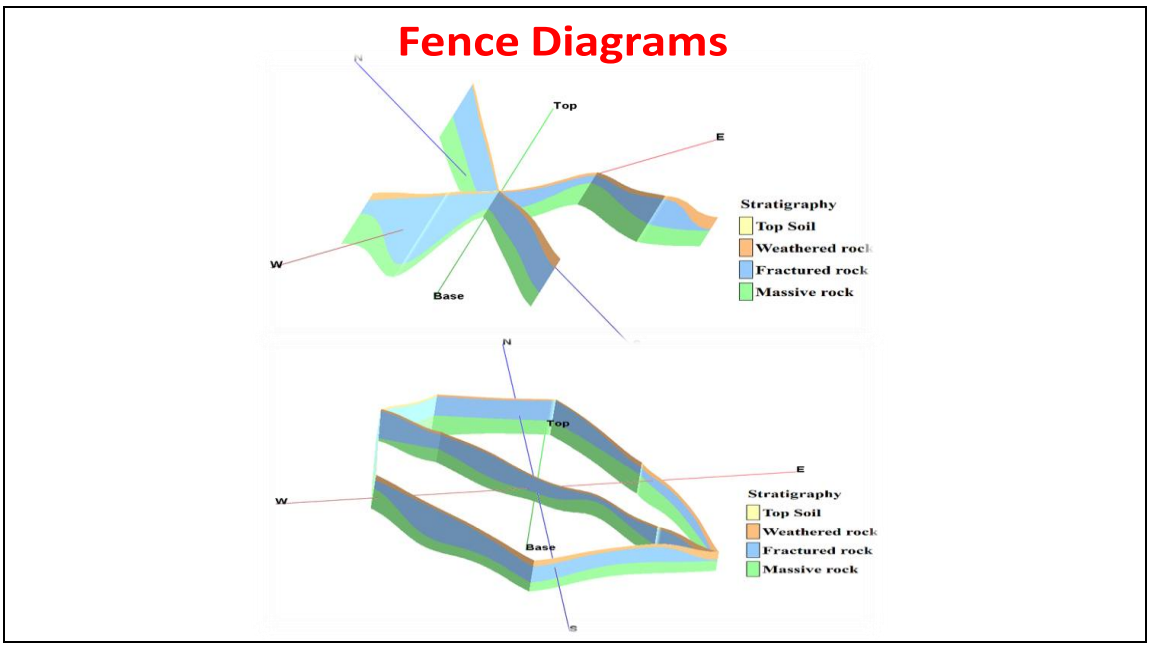

Fig-11c: 3D Aquifer Fence Diagram

3 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION ANDOTHER ISSUES

The main ground water issues are over exploitation, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, deeper water levels especially in Aquifer II, declining water level trend and urbanized areas of Krishnarajanagara city thereby reducing the ground water recharge worthy areas which are all inter-related or inter dependent.

3.1 Comparison of Ground Water Resource and Extraction

The Dynamic Ground Water Resource 2017 and as on 2020 have summarized and presented in **Table-12**. It is observed that the ground water availability in 2020 is more compare to 2017. Groundwater draft in 2020 is more compare to 2017. Stage of Groundwater development is improved (25.22 %) to (24.55%). As Krishnarajanagara taluk is 'safe' category, there is scope to develop the Groundwater resources in this taluk through additional wells. In view of the prevailing practice of abstraction structures, bore wells are the preferred structures in the area.

Table-12 Comparison of ground water availability and draft scenario in Krishnaraja Nagara taluk

Taluk	GW availability (in ham)	GW draft (Extraction) (in ham)	Stage of GW development	GW availability (in ham)	GW draft (Extraction) (in ham)	Stage of GW development
Krishnaraja Nagara	**2017**			**2020**		
	13.733	3,465	25.22%	15.777.44	3,872.91	24.55%

3.2 Chemical quality of ground water and contamination

The water samples were collected in different parts of Krishnarajanagara taluk and analysed in CGWB, Bangalore labrotory. Interpretation from Chemical Analysis results in Krishnaraja Nagara taluk is mentioned as under **Fig 12** given below.

ELECTRICAL CONDUCTIVITY: In general, EC values range from 1162 to 2770 µS/cm in the aquifer-I at 25^{o}C and range from 481 to 1169 µS/cm in the aquifer-II.

NITRATE: Nitrate concentration in ground water ranges from 23.1 and 139.77 mg/l in the Aquifer –I and ranges from 5 and 87.00 mg/l in the Aquifer –II.

FLUORIDE: Fluoride concentration in ground water ranges between 0.49 and 1.27 mg/l in the aquifer-II

Aquifer – II

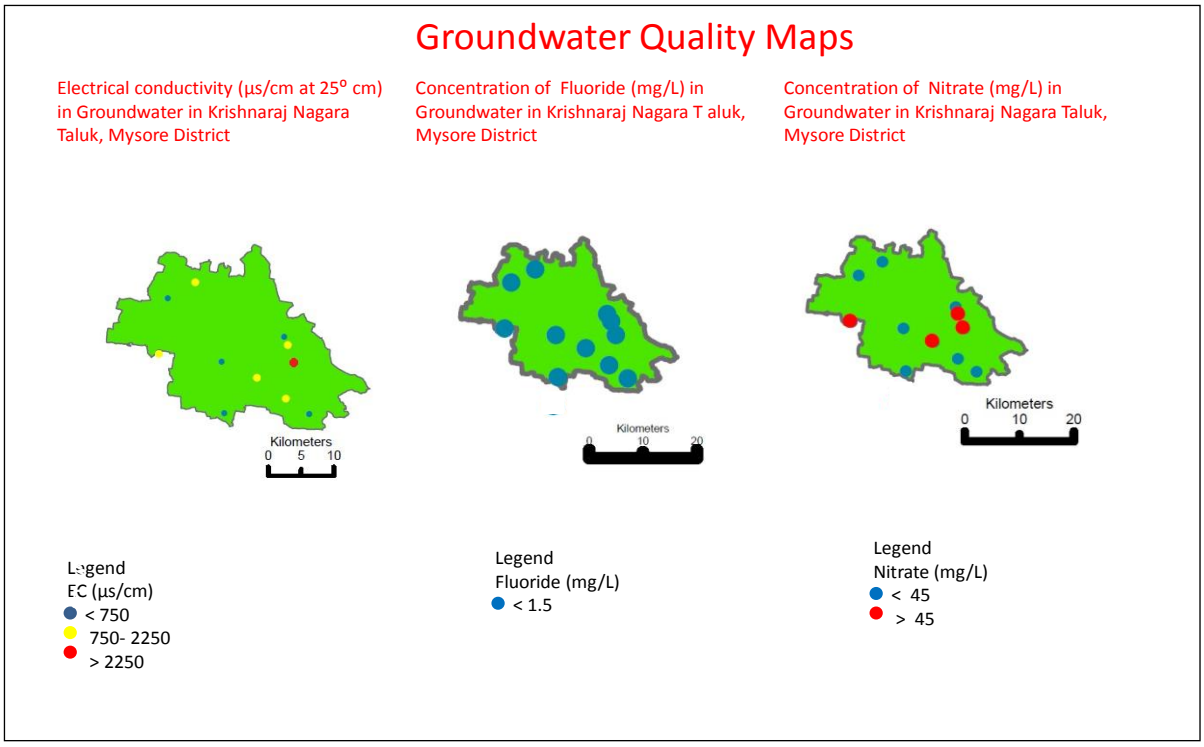

Figure-12.Groundwater Quality Map

4 GROUND WATER RESOURCE ENHANCEMENT

4.1 Resource Enhancement by Supply Side Interventions

Recharge dry **phreatic aquifer (Aq-I)** in the taluk, through construction of artificial recharge structures, viz; check dams, percolation tanks & Sub surface dyke **(Table-13).** 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.

Table-13: Quantity of non-committed surface runoff & expected recharge through AR structures

Artificial Recharge Structures Proposed	Krishnaraja Nagara taluk
Non committed monsoon runoff available (MCM)	15.98
Total no. of existing Artificial Recharge Structures	94
Number of Check Dams	80
Number of Percolation Tanks	14
Number of Sub surface dyke	0
Tentative total cost of the project (Rs. in lakhs)	1098.453 Lakhs
Excepted recharge (MCM)	11.985

4.1.1 Benefit of Artificial recharge scheme

Artificial recharge structures namely Check Dams, Percolation Tanks, Filter Beds, Subsurface Dyke and Nala bunds can be taken up on large scale in the over-exploited areas as a management plan to tackle falling ground water levels.

- These structures have proved in building-up of ground water levels and sustainability of ground water abstraction structures, mainly in bore wells.
- An increase in the area irrigated by ground water source is also observed in the area of influence.
- Such activities help in providing sustainable drinking water to the rural population. The qualitative result from farmer's perception indicate that, there is rising trend in ground water levels in the area of influence, productivity of crops enhanced and improvement in yield is observed in bore wells.
- The cropping pattern has shown that farm households have resumed growing crops such as grapes which were not previously grown in the area.

4.2 Resource Savings by Demand Side Interventions

4.2.1 Advanced irrigation practices

Krishnaraja Nagara taluk falls under Safe category with the stage of groundwater extraction of 24.55%. However Water Use Efficiency (WUE) practices like Drip irrigation needs to be strengthened to save irrigation water by way of precision farming mechanism. This ultimately enhances the area under irrigation potential.

4.2.2 Water Use Efficiency by Micro Irrigation Practices

It is observed that wells and bore wells are the source for 8,210 ha of net irrigation in the taluk. Adoption of water use efficiency (WUE) techniques will contribute in ground water resource enhancement in the long run by way of saving of water. Efficient irrigation practices like Drip irrigation & sprinkler needs to be adopted by the farmers in the existing 8,210 ha of net irrigated area by wells & bore wells.

The water efficient methodology may be applied for growing Paddy and Tobacco 20,952 Ha which is grown in 12,943 ha respectively and is largely ground water dependent as compared to the other crops which are mainly grown during kharif.

Table 14: Details of Resource Enhancement after proposed supply side and demand side interventions

Sl.No	Resource Details	As per 2020 Estimation
1	Net Groundwater Availability in Ham	15,777.44
2	Existing stage of Ground water development in %	24.55
3	Existing Gross Groundwater Draft for all use in Ham	3,872.91
4	Expected recharge from Artificial recharge projects Ham	1198.5
5	Expected improvement in stage of ground water development after implementation of project in %	22.81
6	Expected improvement in overall stage of ground water development in %	1.74

4.2.3 Change in cropping pattern

Agriculture is the main occupation in Krishnaraja Nagara taluk. Water intensive crops like Paddy and Tobacco 20,952 Ha which is grown in 12,943 ha of net cropped area of 64,225 ha. However, oil seeds are grown during kharif and rabi. At present (2020), the stage of ground water extraction is 24.55% and taluk has been categorised as Safe, thus change in cropping pattern has not been suggested.

4.3 Regulation and Control

Krishnaraja Nagara taluk has been categorized as **Safe**, since the stage of ground water development has reached 24.55% (GEC 2020), it may be encouraged to extract the ground water with care so that further ground water exploitation should not happen in the taluk However mandatory guideline issued by Government of Karnataka like rain water harvesting and Artificial recharge structures should be constructed. Ground water recharge component needs to be made mandatory in the non-command area of the taluk for further development of ground water.

4.4 Other interventions proposed

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

5 SUMMARY AND RECOMMENDATIONS

The summary of Management plan of Krishnaraja Nagara taluk is given below.

As per the resource estimation – 2020, Krishnaraja nagara taluk falls under Safe category with the stage of groundwater extraction is 24.55 %. However, there is need to formulate management strategy to tackle the water scarcity related issues in the taluk in the coming days to avoid water crisis in the future. It is suggested to adopt a scientific and multi-pronged ground water management strategy covering supply side interventions, demand side interventions, ground water development interventions and groundwater quality protection 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 15.98 ham. This can be used to recharge the aquifer mainly through percolation tanks (14) and check dams (80). The volume of water expected to be conserved/recharged is 1198.5 ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 10.98 Cr. The additional area which can be brought under assured ground water irrigation will be about 1400 hectares. However, the figures given are tentative and pre-field studies / DPR are recommended prior to implementation of these recharge structures.

Ground water resource enhancement by demand side interventions: At present about 13 % of irrigation is by wells and bore wells (ground water). The micro irrigation practices like drip and sprinkler irrigation are comparatively less practiced in comparison with traditional surface flooding mode of

irrigation. The micro irrigation water efficient methodology needs to be adopted for growing water intensive crop like Paddy, Sugarcane and Tobacco which is grown in the cropped area largely and groundwater dependent. Implementation of efficient irrigation techniques will contribute in saving Groundwater.

Change in cropping pattern: Farmers are facing inadequacy of groundwater for agriculture during summer. Water intensive crops like Paddy and Tobacco 20,952 Ha which is grown in 12,943 ha. However, oil seed is grown during kharif and rabi period. At present (2020), the stage of ground water extraction is 24.55% and taluk has been categorised as Safe, thus change in cropping pattern has not been suggested.

By adopting the supply side and demand side management plan itself, the stage of groundwater extraction decreases from 25.22% to 24.55 % and the taluk falls under safe category.