



# 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**

**Krishnarajapete Taluk, Mandya District,  
Karnataka**

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु  
South Western Region, Bengaluru

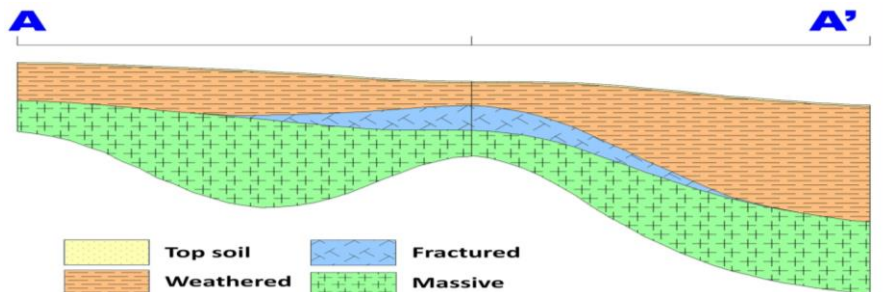
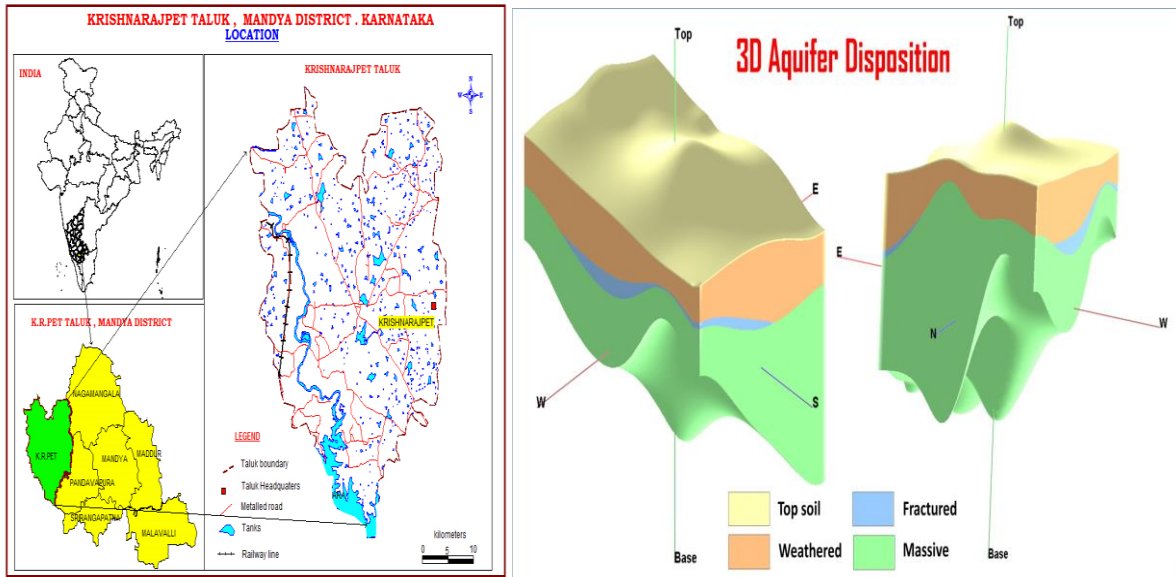
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# AQUIFER MAPS AND MANAGEMENT PLAN, KRISHNARAJAPETE TALUK, MANDYA DISTRICT, KARNATAKA STATE

(AAP – 2021-2022)



By  
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# AQUIFER MAPS AND MANAGEMENT PLAN, KRISHNARAJAPETE TALUK, MANDYA DISTRICT, KARNATAKA STATE

## 1 SALIENT INFORMATION

Name of the taluk: **KRISHNARAJPET**

District: **MANDYA**

State: Karnataka

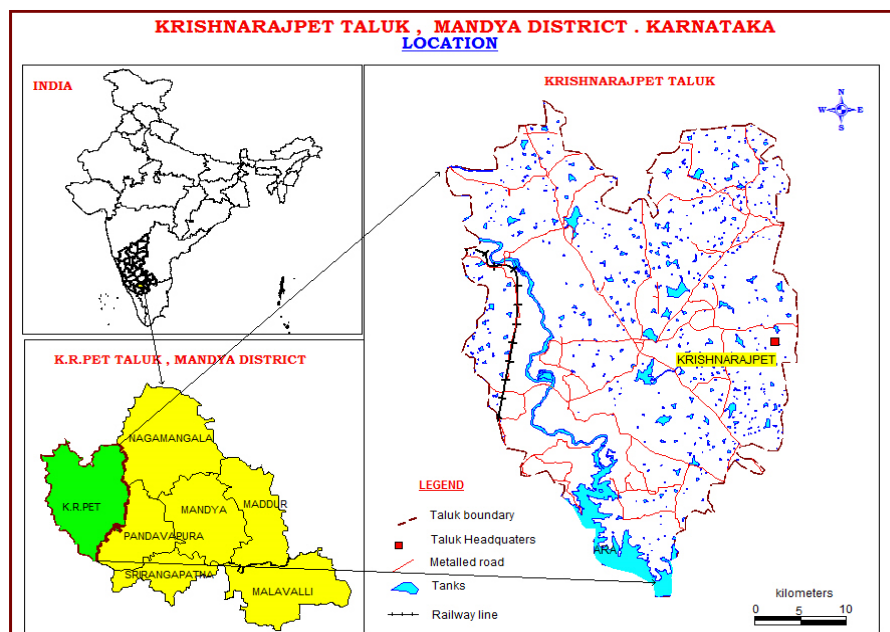
Area: 897 sq.km.

Population: 260479

Annual Normal Rainfall: 651 mm

### 1.1 Aquifer management study area

Aquifer mapping studies were carried out in Krishnarajpet Taluk, Mandya district of Karnataka, covering an area of 897 sq.kms under National Aquifer Mapping. Krishnarajpet Taluk of Mandya district is located between north latitude  $12^{\circ}37'39.44''$  and  $12^{\circ}45'06.30''$  & east longitude  $76^{\circ}21'48.44''$  and  $76^{\circ}36'03.72''$  and is covered in parts of Survey of India Toposheet Nos. 57D/5,6,9,10. It is bounded by Holenarasipura Taluk, Hassan District in West, Nagamangala Taluk, Mandya District in East, Kunigal Taluk of Tumkur district in north, Srirangapattana Taluk of Mandya district on the southern side. Location map of Krishnarajpet Taluk of Mandya district is presented in **Fig. 1**.



**Fig. 1: Location Map of Krishnarajpet Taluk, Mandya district**

Krishnarajpet town is the Taluk headquarter and Municipality of Krishnarajpet Taluk. There are 6 Hoblis and 316 villages in Krishnarajpet Taluk. It is situated at about 159.5 km distance from Bangalore. It can be reached from Bangalore by many ways, via Pandavpura Bangalore-Mysore Highway. Railway route between Mysore and Hassan connects K.R.Pet from Mandhagere station.

## 1.2 Population

According to 2011 census, the population of Krishnarajpet Taluk is 2,60,479. Out of the total population 1,30,241 constitute the male population and 1,30,241 is the female population. The urban population is 25,946 and rural one is 2,34,533. Decadal change in population from 2001-2011 is 4.92% in Krishnarajpet Taluk. Decadal change in rural and urban population is 3.9 % and 14.9 % respectively. The total numbers of families in the Taluk are 61,035. The density of population is 290.40 persons per square km.

## 1.3 Rainfall

Krishnarajpet Taluk has semi-arid climate. Dry and hot weather prevails in major part of the year. All throughout the year, moderate weather prevails. The area falls under Southern Dry Agro-climatic Zone of Karnataka state and is categorized as drought prone. The climate of the study area is quite agreeable and free from extremes. The year is usually divided into four seasons namely 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. Rainfall generally decreases from west to east. April and May are regarded as the summer months with maximum temperature around 34 degree Celsius and minimum temperature is around 19 degree Celsius.

There are 5 rain gauge stations in Krishnarajpet Taluk, the rainfall data in respect of these stations from the year 1981 to 2010 were analyzed. The data pertaining to these gauges is of long-term nature and are well maintained. It is presumed that they are representative of the Taluk and the same is used for analysis. Normal annual rainfall in the Taluk for the period 1981 to 2010 is **651 mm**.

Computations were carried out for the **30** years blocks of **1981- 2010** on Mean, Standard deviation and coefficient of variation (CV) of each month pre -monsoon, monsoon, post monsoon and annual and are shown in **Table 1**.

The mean monthly rainfall at Krishnarajpet Taluk is ranging between 4 mm during January to 183 mm during October. The CV percent for pre-monsoon, monsoon and post monsoon season is 62, 26 & 43 percent respectively. Annual CV at this station works out to be 20 percent.

**Table-1: Statistical Analysis of Rainfall Data of Krishnarajpet taluk, Mandya district (1981 to 2010)**

STATION		JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	RAINFALL
Krishnarajpet	Normal Rainfall (mm)	4	6	18	52	102	181	69	60	73	126	328	183	50	10	243	753
	STDEV	14	18	34	41	84	108	54	49	53	81	132	126	45	20	123	196
	CV%	240	178	195	70	99	62	37	38	49	53	26	55	124	184	43	20

### Annual Rainfall (2015-2019)

Computation were carried out for the annual rain fall for the year 2015-2019, the annual rainfall for the year 2015,2016,2017,2018 and 2019 is 1052,439,926,924 and 890.9 mm respectively. The annual rainfall from 2015-2019 for the individual month and monsoon season is presented in **Table-2**.

**Table 2: Analysis of Annual Rainfall Data of Krishnarajpet Taluk, Mandya District, Karnataka for the Period 2015 to 2019**

ANNUAL RAINFALL (2015-2019)																	
Year	JAN	FEB	MAR	APR	MAY	PRE MONSOON	JUN	JUL	AUG	SEP	SOUTH WEST MONSOON	OCT	NOV	DEC	NORTH EAST MONSOON	AL	RAINFALL ALL
2015	0	0	20	109	157	286	169	169	90	77	505	81	176	4	261		1052
2016	0	0	0	1	95	96	96	77	40	25	238	51	24	30	105		439
2017	0	0	61	86	191	338	36	22	77	306	441	122	7	18	147		926
2018	0	3	26	95	290	414	92	64	53	107	316	187	7	0	194		924
2019	0	0	0	31.6	44.4	76	64.9	87	182	157	490.9	291	31	2	324		890.9

### 1.4 Agriculture & Irrigation

Agriculture is the main occupation in Krishnarajpet Taluk, since 90.1% of the total population constitutes the rural population. The amount of rainfall and its distribution throughout the season contributes to the cropping pattern in the area. There are two agricultural seasons namely Kharif (June – October) and Rabi (Mid October – Mid February). Most of the agriculture is through canal, Bore-well and ground water is the major source of irrigation. Important Kharif crops are paddy, maize, ragi, jowar, and vegetables. Main crops of Rabi season are pulses and oilseeds. Among the commercial crops, Paddy, Ragi and sugarcane are grown. Fruits and vegetables are also grown in the area (**Table 3**).

**Table 3: Area wise crops grown in Krishnarajpet Taluk**

Year	Paddy	Jowar	Maize	Ragi	Pulses	Sugarcane	Oil seeds	Total fruits	Total vegetables	Total Food Grains
	<b>Area under cultivation (in ha)</b>									
<b>2015 - 16</b>	10372	64	286	10145	7132	2137	1289	1613	2106	27999

(Source: District At A glance 2015-16)

During the year 2015-16, percentage of gross sown area of total geographical area is 52.66 % and net sown area was 44.13 % in Krishnarajpet Taluk (**Table-4** and **Fig 2**). Irrigation practices by different sources in the Taluk are presented in **Table 5**.

**Table 4: Land use pattern of Krishnarajpet Taluk**

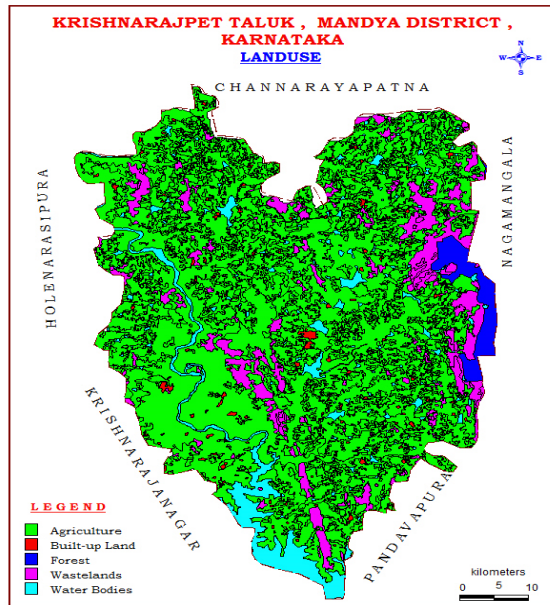
Year	Total Geographical Area (ha)	Area under Forest (ha)	Area not available for cultivation (ha)	Other uncultivated land (ha)	Total fallow land (ha)	Net sown area (ha)	Area sown more than once (ha)
<b>2015-16</b>	91551	5767	12642	22274	10502	40407	7804

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

**Table 5: Irrigation practice in Krishnarajpet Taluk**

Source of irrigation	No. of irrigation source	Net area irrigated (ha)	Gross area irrigated (ha)
Canals	386.25	14986	17380
Tanks	142	5323	6250
Wells	1145	1071	1491
Tube/ Bore wells	9644	3350	4258
Lift Irrigation	6	128	128
Other Sources	Nil	158	258
<b>Total</b>	<b>11323.25</b>	<b>25016</b>	<b>29765</b>

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

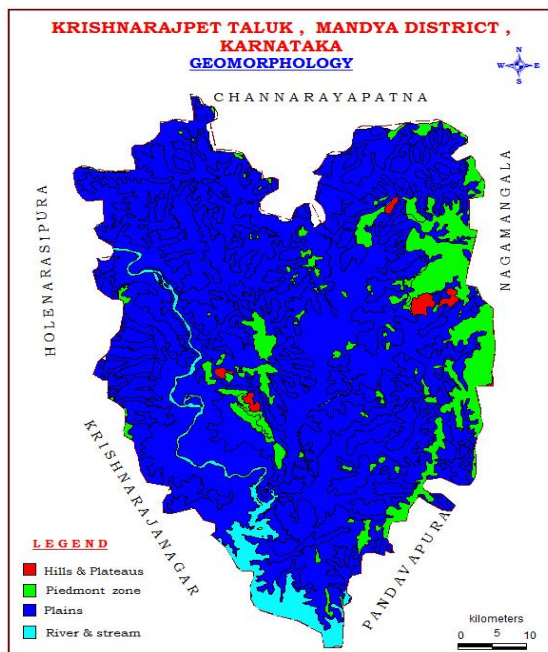


**Fig. 2: Land use map**

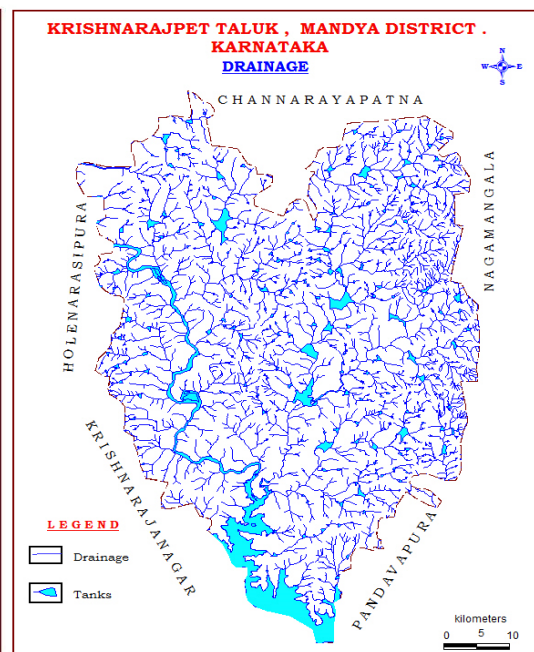
### 1.5 Geomorphology, Physiography & Drainage

Geomorphologically, Krishnarajpet Taluk belongs to Southern Maidan region which is characterized by plain area with highly undulating terrain topography. The hills are mostly in the eastern and western part of the Taluk with a general slope in the westerly direction. There are piedmont zones in mostly in eastern side in between which are scattered unevenly. (Fig. 3).

The Taluk lies in Cauvery basin and Hemavathi river sub basin, which is a tributary to the Cauvery river. They exhibit dendritic to sub-dendritic drainage pattern.(Fig.4.) Hemavathi river originated from Ballala Rayana Durga in Chikmagalur District, the Hemavathi river flow through krishnarajpet, before merging with River Cauveri. It is perennial in Nature.



**Fig. 3: Geomorphology map**



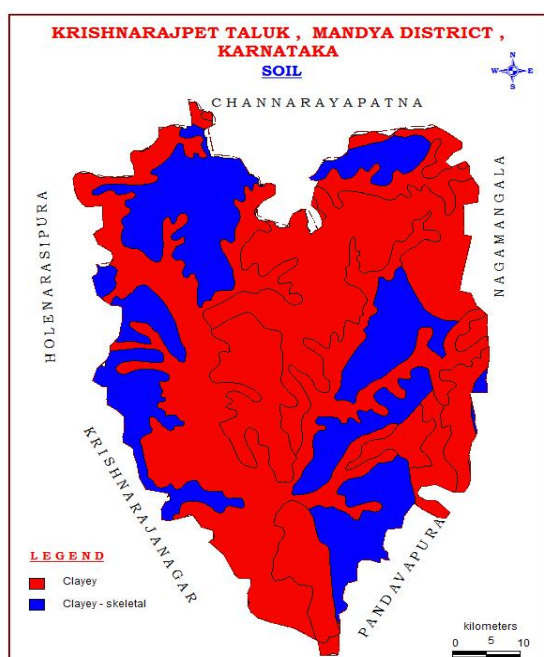
**Fig. 4: Drainage map**



## 1.6 Soil

The Taluk is mainly covered by clayey soil and varieties of clayey soil like mixed and skeletal variety (**Fig. 5**). Soil derived from granite and gneiss with occasionally patches of Schist in taluk are found distributed. Soil ranges from red sandy loam to red clay loam, very thin in the ridge and in higher elevation and comparatively thick in valley portion are distributed. Red sandy loam are altered product of Granite gniesses, shallow to medium in depth intermixed with quartzite and gravelly material whereas the red clayey loam are altered product of schist.

Water holding capacity is low. Infiltration rate of red loamy and red soil are 2 to 12 cm/hrs to 1 to 3 cm/hrs respectively. The soil in taluk are thin gravelly and underlain with Murram zone containing weathered zone.



**Fig. 5: Soil map**

## 1.7 Ground water resource availability and extraction

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

**Table-6: Total Ground Water Resources (2017) (Ham)**

Taluk	Annual replenishable GE resources (in ham)	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic (in ham)	Fractured (Down to 260m) (in ham)	Dynamic + phreatic in-storage + fractured (in ham)
Krishnarajpet	11366	3059	1874	16299

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

Year	Existing Gross GW extraction for Irrigation (ham)	Existing Gross GW extraction for domestic and industrial water supply (ham)	Allocation for domestic and industrial use for the next 25 years (ham)	Net GW availability for future Irrigation development (ham)
2017	7258	334	552	5362

## 1.9 Water level behavior

The details of ground water levels during per-monsoon and post-monsoon and their fluctuation between per and post-monsoon periods are furnished below.

### (a) Depth to water level

#### Aquifer – I

- Pre-monsoon: 2 – 20 mbgl (Fig:6)
- Post-monsoon: 2 – 10 mbgl (Fig:7)

#### Aquifer – II

- Pre-monsoon: 2.64– 21.07 mbgl
- Post-monsoon: Paucity of Data

### (b) Water level fluctuation

#### Aquifer – I

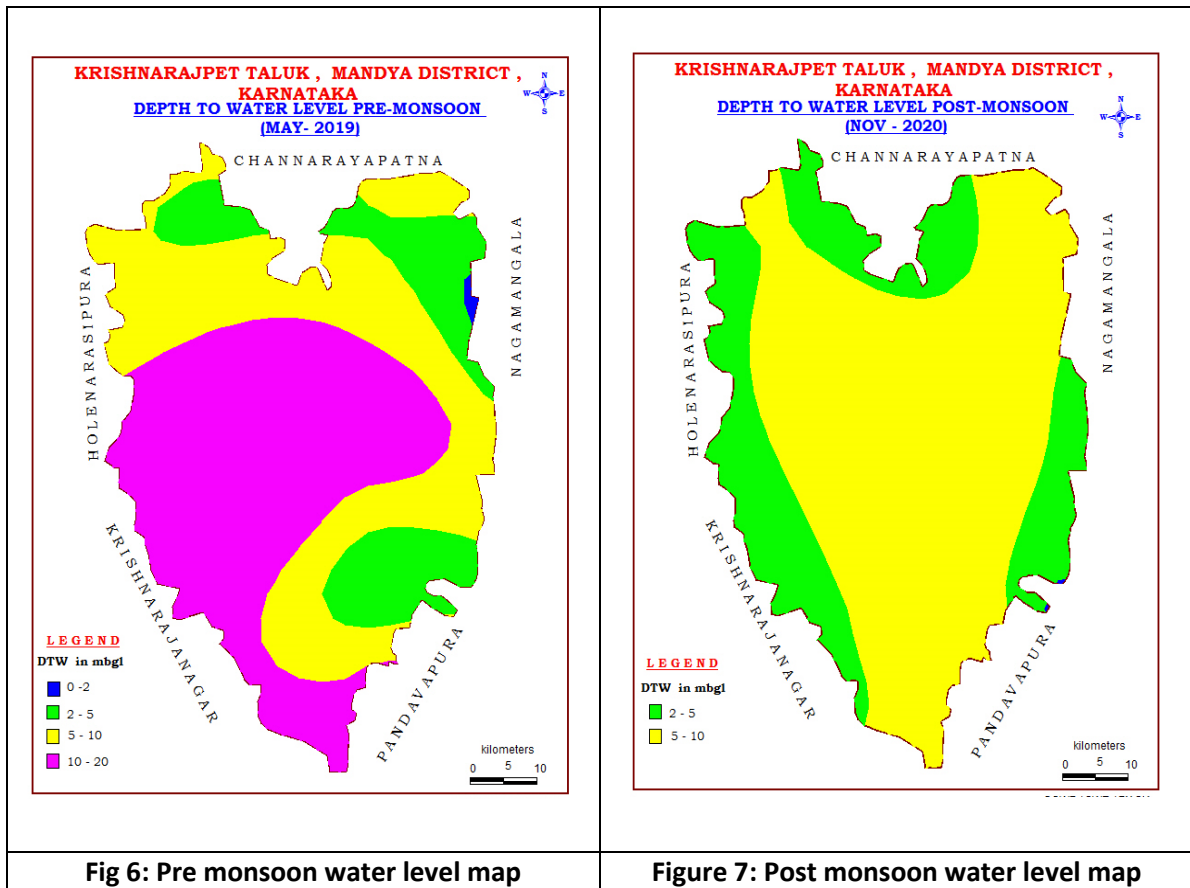
Range from 2 to 10 mbgl.

#### Aquifer – II

Rise range from 0.201 to 0.404 mbgl & Fall range from 0.054 to 1.075 mbgl.

**Table-7: Depth to water level for Pre-monsoon and Post-monsoon**

Sr. No	Village	Source	Pre-monsoon Depth to water May-2019 (mbgl)	Post-monsoon Depth to water Nov-2019 (mbgl)	Water level Fluctuation
Aquifer-I					
1	Baligatta	Dug Well	2.20	2.20	0
2	Krishnarajapet	Dug Well	8.66	6.78	1.88
3	Maravanahalli	Dug Well	12.70	4.50	8.2
4	Tendekere	Dug Well	2.46	2.46	0
Aquifer-II					
5	Sindaghatta	Borewell	21	-	



In the major part of the taluk, the depth to water is in the range of 5 to 20 mbgl during both the pre-monsoon and post-monsoon periods of 2019. Further, shallow water level range from 2-5 mbgl is seen distributed in small patches in eastern part of taluk during the pre-monsoon period. During the post-monsoon period, depth to water level in the range of 2-5 mbgl is seen in the western, northern and eastern part of the taluk.

## 2 AQUIFER DISPOSITION

Granite occupy nearly 80% of the taluk covering eastern part whereas schistose formation and basalt occurs in the rest 20% of the Taluk (**Fig 8**). The gneisses comprise of migmatites associated with biotites and hornblendes. The granites are grey in colour and are fine to coarse grain in nature. Ground water occurs under water table to semi confined condition depending upon disposition of aquifer which is mainly granite and schist. Ground water occur under water table to semi confined condition in granite whereas in schist groundwater occur in weathered, jointed and fractured zone under water table condition.

Ground water exploration programme of CGWB was carried out in different phases in Mandya district and exploratory wells have been drilled in Krishnarajpet Taluk under this programme. The drilling results reveal that the weathered, jointed and fractured granite is the potential aquifer system in the area. (**Table.8**)

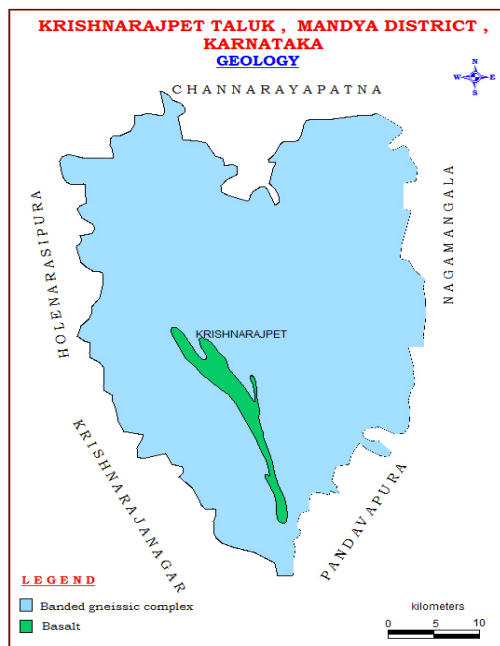
Majority of the dug well in granitic gneiss ranges in depth from 10.3m to 21.2m having a weathered zone from 3m to 18m thickness. Water level is in the range of 2 m to 20 m. Pumping test of 500 minutes conducted in open wells have revealed that the discharge ranges between 1 to 7.18 lps with a drawdown of 15.53 m and unit area specific capacity of 32.18 lpm/m/m<sup>2</sup>.The basic characteristics of the aquifers are presented in **Table.9**.

## 2.1 Number of aquifers:

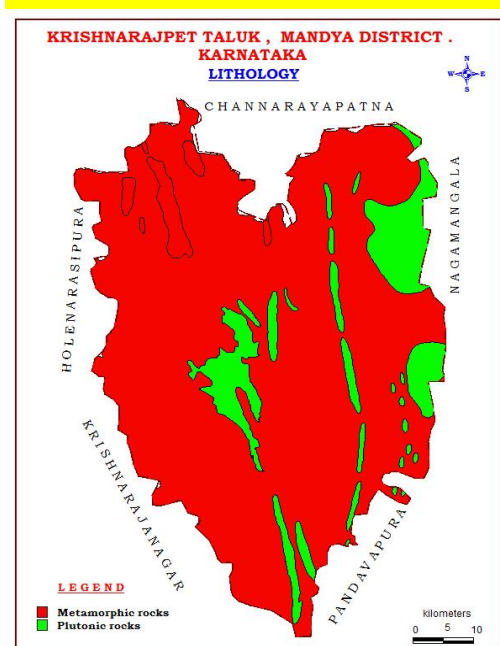
In Krishnarajpet Taluk, there are mainly two types of aquifer systems; (**Fig 9**)

i. **Aquifer-I** (Phreatic aquifer, weathered zone) comprising of **Granitic Gneiss**

ii. **Aquifer-II** (Fractured zone) comprising of **Fractured Granitic gneiss**



**Fig 8: Geology Map**



**Fig 9: Lithology Map**

**Fig 9** showing the lithology of Krishnarajpet taluk, Metamorphic rock basically cover more part of taluk, generally in Western, central and some part of Eastern part of taluk. Plutonic rocks spread in central & Eastern part of taluk.

**Table-8: Details of Ground Water Exploration**

S. No	Location	Long	Lat	Depth m bgl	Casin g (m)	Lithology	SWL (mbgl)	Q (lps)	T (m <sup>2</sup> /day)
1	Santhebache nahalli-EW	76.5821	12.8081	153.5	10	BG	5.242	0.88	-
2	Santhebache nahalli-OW	76.582	12.8083	135.2	6	BG	7.43	5.56	-
3	Harahalli	76.564	12.675	75.9	5.000	ARCN, GRGN	8.23	2.82	7
4	Kundur	76.481	12.738	75.6	21.00	ARCN, GRGN	4.25	0.21	270
5	Ranganathap	76.531	12.582	90	23.90	ARCN,	13.28	5.25	16

	ura					GRGN			
6	Santebachahalli	76.597	12.811	90	12.00	ARCN, GRGN	12.74	3.5	1.2
7	K.R.Pet EW	76.485	12.658	157.95	33.1	Amph hist.	12.54	4.5	14.83
8	K.R.Pet OW	76.485	12.658	200.51	20.8	Amph hist.	15.85	3.48	14.96
9	Sindugatta EW	76.563	12.693	143.17	16.5	GR GN	18.07	6.2	13.67
10	Sindugatta OW	76.563	12.693	157.95	18	GR GN	15.98	6.11	7.56
11	Shilnare EW	76.563	12.631	181.87	18	GR GN	7.51	7.18	62.15
12	Shilnare OW	76.563	12.631	190.51	18.3	GR GN	11.46	7.2	32.22
13	Akkihebbale EW	76.397	12.622	154.31	26.4	GR GN	10.4	7.3	290.71
14	Kikkeri EW	76.422	12.771	174.28	41.6	GR GN	7.43	-	67
15	Kikkeri OW	76.422	12.771	173.23	40	GR GN	5.23		59.47
16	Bukinakere	76.5222	12.5597	200	4.5	GR GN	4.35	-	-
17	Chokanahalli	76.5361	12.5417	200	10	GR GN	13.28	-	-
18	Bannanakeree	76.5417	12.5917	200	20	GR GN	12.85	-	-
19	Tendekere	76.5611	12.5889	200	7	GR GN	12.22	-	-
20	Shilanere	76.5625	12.6306	200	17.5	GR GN	7.45	-	-
21	Sindhughatta	76.5458	12.6931	200	15	GR GN	8.23	-	-

**Table-9 Basic characteristics of each aquifer**

<b>Aquifers</b>	<b>Weathered Zone (Aq.-I)</b>	<b>Fractured Zone (Aq.-II)</b>
Depth drilled (mbgl) under exploration programme	75.6 to 200.51	
Prominent Lithology	Weathered Gniess/Schist	Fractured Gniesses/Schist
Thickness range (mbgl)	40	Fractures upto 200 mbgl
Depth range of occurrence of fractures (mbgl)	4.5-41.6	26.49-167.59
Range of yield potential (lps)	Poor yield	1-7.18
Specific Yield	2%	0.2%
T (m <sup>2</sup> /day)	-	1.2-62.15
Quality Suitability for Domestic & Irrigation	Generally Suitable	Generally Suitable

## 2.2 3 D aquifer disposition and Cross-Sections

The sub-surface aquifer disposition of the study area are prepared based on the drilling data obtained from exploratory drilling programme for generating 2D and 3D sections and fence diagrams/models through Rock works software. The outputs thus generated are presented in depicted in Fig.10, Fig.11 and Fig.12.

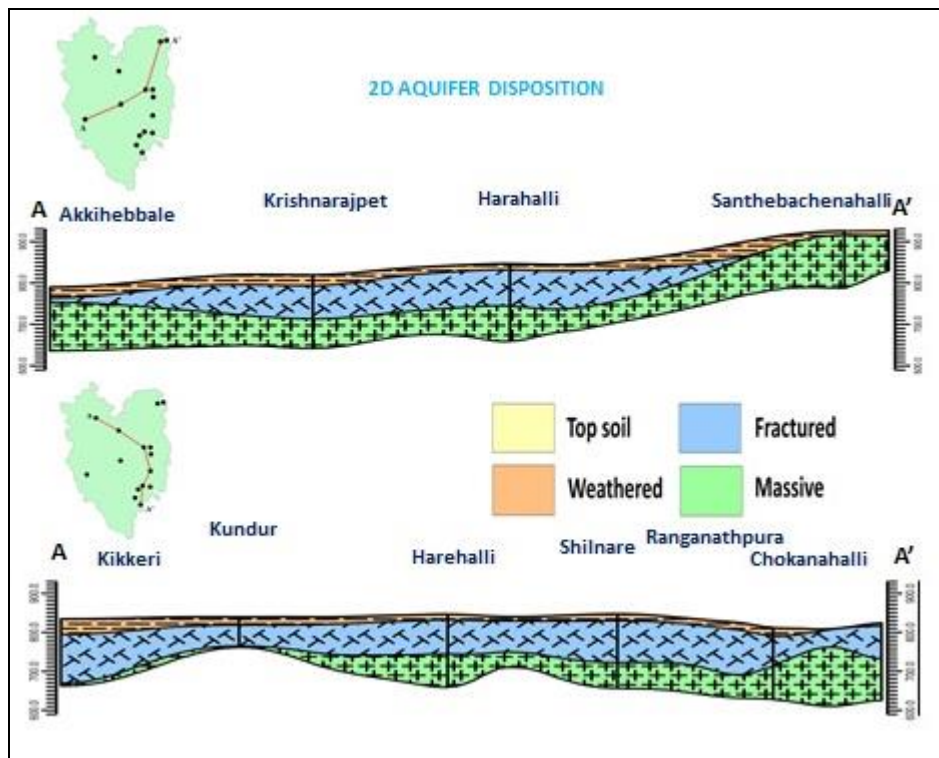


Fig-10: 2D Aquifer Disposition

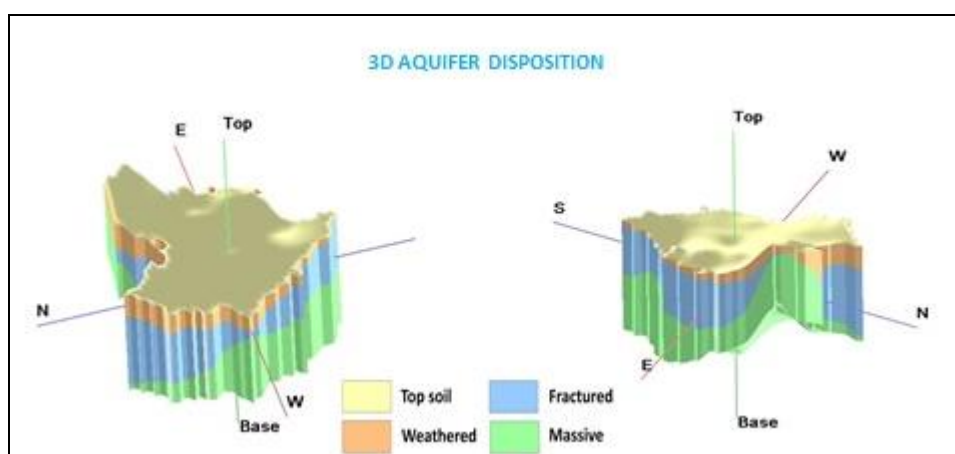


Fig-11: 3D aquifer Disposition

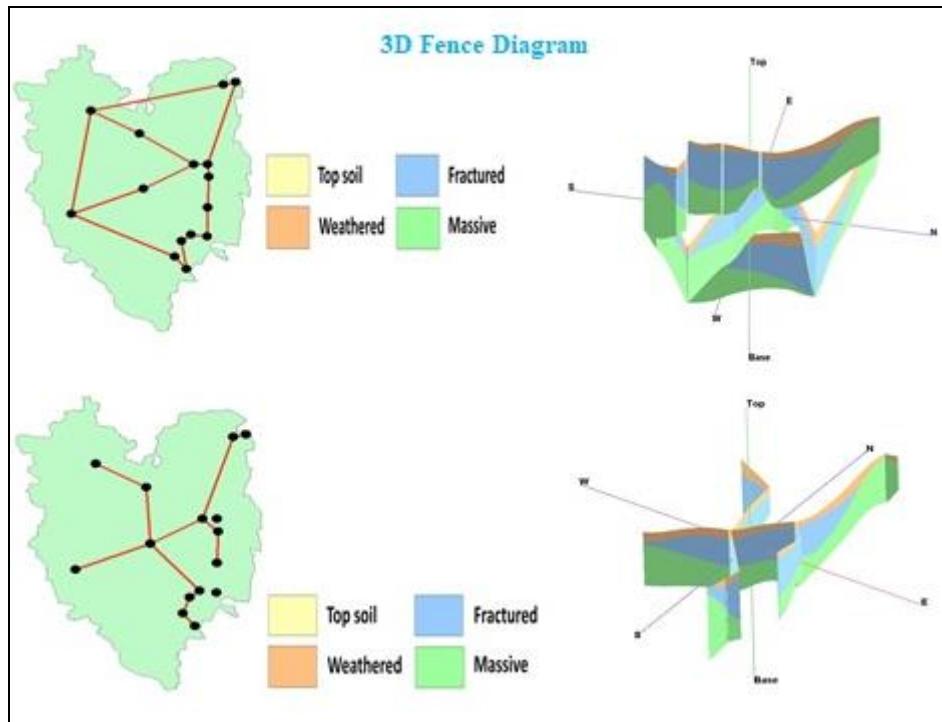


Fig-12: Aquifer Fence Diagram

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

#### 3.1 Aquifer wise resource availability and extraction (2020)

The ground water resource estimated as on 2017 is summarised and given above in Table.6 above. The ground water resources computed as on 2020 is shown in Table.10. The taluk is categorised as “Safe” with stage of ground water extraction of 35 %. As mentioned above, Total Availability of Ground Water Resource ( Phreatic + Phreatic In-storage + fractured In-storage)is estimated to be 16299 ham for the taluk. The Comparison of ground water availability and draft scenario in Krishnarajpet taluk is presented in Table.11.

Table.10 Ground Water Resource availability and stage of extraction as on 2020

Taluk	Annual Extract GW resource (ham)	Existing Gross GW extraction for Irrigation (ham)	Existing Gross GW extraction for domestic and industrial water supply (ham)	Existing Gross GW extraction for all uses (ham)	Allocation for domestic and industrial use for the next 25 years (ham)	Net GW availability for future Irrigation development (ham)	Stage of GW development (%)	Category
Krishnarajpet	8758.12	2710.88	361.42	3072.30	399.45	5661.13	35.08	Safe

**Table.11 Comparison of ground water availability and draft scenario in Krishnarajpet taluk**

Taluk	2013			2017			2020		
	GW Availability	GW Draft	Stage of GW withdrawal	GW Availability	GW Draft	Stage of GW withdrawal	GW Availability	GW Draft	Stage of GW withdrawal
Krishnarajpet	12278	7737	63	11366	7592	67	8758.12	3072.30	35.08

From the above comparison, it can be observed that the stage of ground water extraction is more during 2013 & 2017 and less in 2020. From, 2013 to 2020, the availability of ground water availability is reduced from 12278 to 8758 ham. During the same period, there is reduction in usage with reduced ground water extraction/draft.

### 3.2 Chemical quality of ground water and contamination

The results of Chemical Analysis of ground water samples (Phreatic aquifer) in the taluk is summarized and presented in **Table.12**.

**(a) Aquifer – I:** 2 samples were collected from NHS dug wells representing Aquifer – I in Krishnarajpet Taluk and chemical analysis result indicate that the

- **E.C:** EC value is in the ranges of 395 to 2700 m/mhos/cm at 25°C. Highest value is observed in **Krishnarajpet town. (Fig-13)**
- **pH:** The value of pH ranges from 6.36 to 7.42.
- **Cl:** Cl ranges from 41 mg/l to 539.6 mg/l.
- **NO<sub>3</sub>:** The value of NO<sub>3</sub> ranges from 0 to 142.05 mg/l. Highest value of 142.05 mg/l is found in **Krishnarajpet** which is above the permissible limit as per BIS, 2012 drinking water standards. **(Fig-14)**
- **F:** All the samples show fluoride within desirable limit as per BIS, 2012. **(Fig-15)**

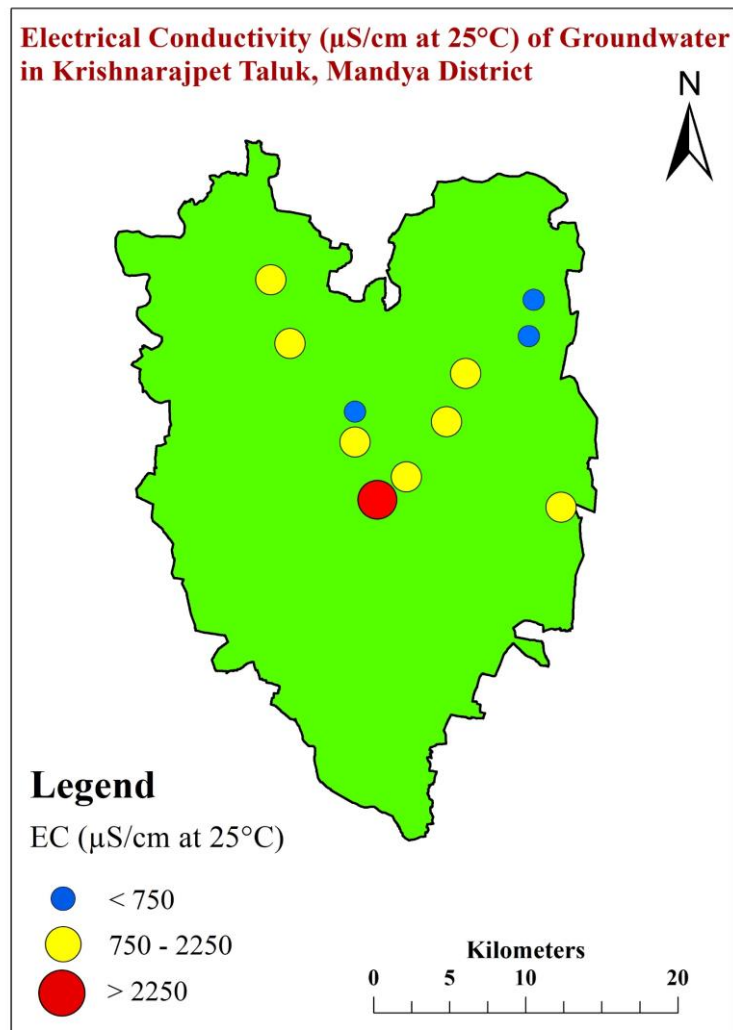
**(b) Aquifer -II:** 9 samples were collected from borewells and Hand pump which represented the aquifer II in Krishnarajpet Taluk.

- **E.C:** EC value in groundwater is in the ranges of 330 to 2220 m/mhos/cm at 25°C. Highest value is observed in **Sarangi** village.
- **pH:** The value of pH ranges from 7.2 to 10.71.
- **Cl:** Cl ranges from 24.85 mg/l to 298.2 mg/l.
- **NO<sub>3</sub>:** The value of NO<sub>3</sub> ranges from 7.11 to 97 mg/l. Highest value is observed in **Sarangi** village which is above the permissible limit as per BIS, 2012 drinking water standards.
- **F:** All the samples show fluoride value within desirable limit as per BIS, 2012 standards

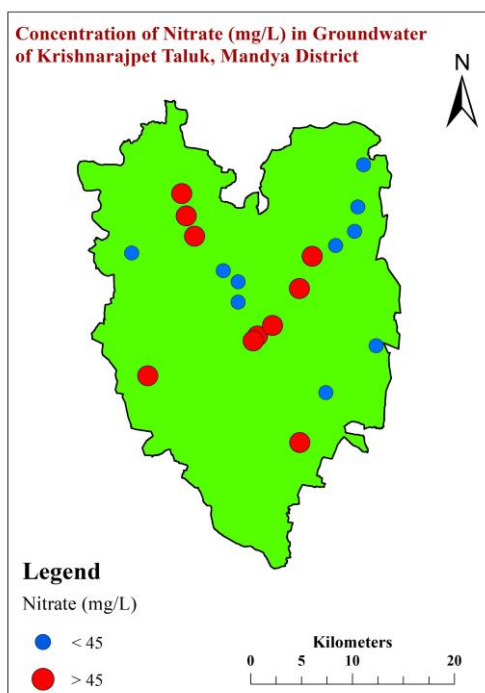


**Table-12: Quality of ground water in Krishnarajpet taluk of Mandya district**

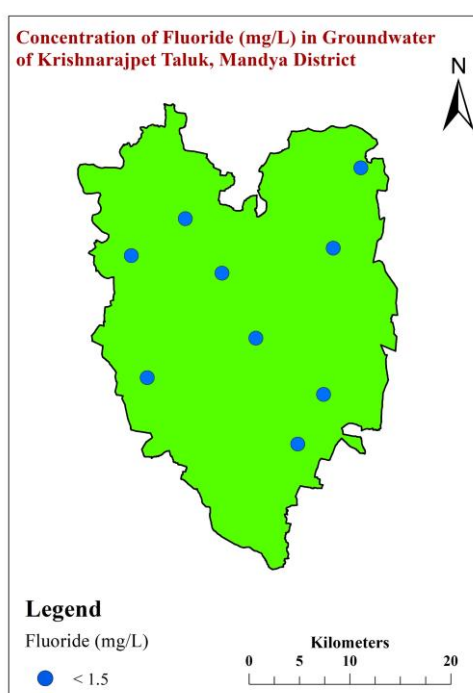
S. No	Location	EC	NO3
1	Sarangi	2220	-
2	Krishnarajpet	2700	83
3	Akkihabbal	-	52
4	Kikkeri	-	90
5	Bukinakere	-	60



**Fig-13 Distribution of Electrical Conductivity**



**Fig-14 Distribution of Nitrate**



**Fig-15 Distribution of Fluoride**

In general, the ground water quality in Krishnarajpet Taluk is good and potable except in some localized areas where nitrate and salinity content are found to be higher than the permissible limit. Ground water samples have been found suitable for agriculture & irrigation purposes.

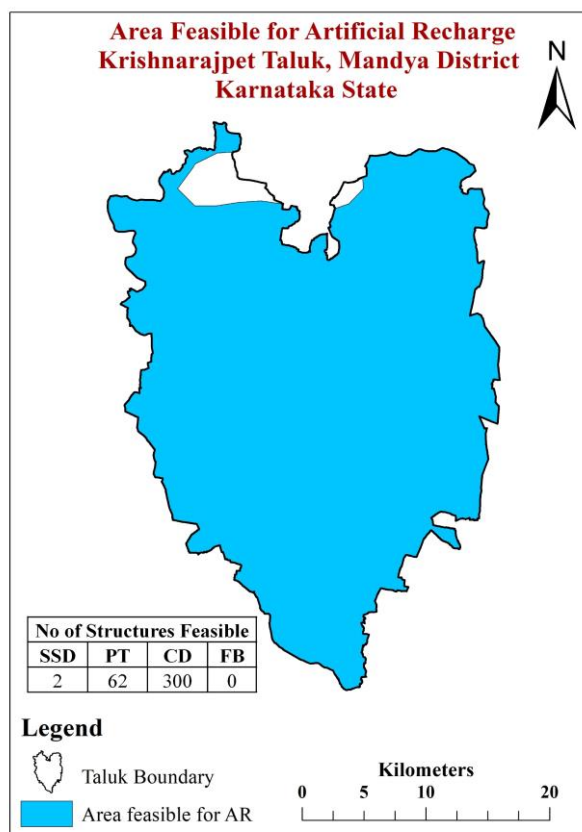
## 4 GROUND WATER RESOURCE ENHANCEMENT

### 4.1 Artificial recharge and proposed interventions

Increase in agricultural activity and excessive ground water withdrawal has resulted in depletion of ground water table, reduction in yield of bore wells and deterioration of ground water quality. Krishnarajpet Taluk is drought prone. Thus, there is need for ground water management, enhancement of storage capacity of aquifers, protection of ground water quality and proper utilization of ground water. The details of the artificial recharge plan proposed for the taluk as per the Master Plan of CGWB 2020 is detailed in **Table.13**. Map showing the area feasible for artificial recharge is shown in **Fig.16**.

**Table 13: Quantity of water proposed to be made available through non-committed surface runoff**

Non committed monsoon runoff available (MCM)	68.663
<b>Artificial Recharge Structures Proposed</b>	
Area feasible for artificial recharge structures (sq. km)	633
Number of Check Dams feasible	300
Number of Percolation Tanks feasible	62
Number of Point Recharge structures completed by GoK	270
Tentative total cost of the project (Rs. in lakhs)	4274.563
Recharge capacity of percolation tank (MCM)	34.331
Recharge capacity of Check dam (MCM)	17.166
Recharge capacity of filter bed (MCM)	6.866
Expected/Likely recharge (MCM)	<b>51.497</b>



**Fig-16 Area suitable for AR Structures**

The likely improvement in ground water availability on implementation of the recharge augmentation programme is summarized in **Table.14**.

**Table 14: Present ground water availability and draft scenario (2020) in Krishnarajpet Taluk and expected improvement in Stage of Ground Water Development in future, on implementation of artificial recharge schemes**

Taluk	Cumulative Annual Ground Water Availability	Existing Gross Ground Water Draft for All Uses	Existing Stage of Ground Water Development	Expected Recharge from Proposed Artificial Recharge Structures	Cumulative Ground Water Availability after Artificial Recharge Structure Implementation	Stage of Ground Water Development after Artificial Recharge Structure Implementation	Expected Improvement in Overall Stage of Ground Water Development
	HAM	HAM	%	HAM	HAM	HAM	%
<b>Krishnarajpet</b>	8758.12	3072.30	<b>35.08</b>	5149.7	13907.82	22.09	<b>12.99</b>

## 4.2 Water Use Efficiency by Micro Irrigation Practices

It is observed that wells and bore wells are the source for **5749 ha** of net irrigation in the taluk constituting about 65% of the irrigated area. 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 5749 ha of net irrigated area by wells & bore wells. At present (2020), the irrigation draft is **2710.88** ham.

The water efficient methodology may be applied for growing sugarcane which is grown in 2137 ha and is largely ground water dependent as compared to the other crops which are mainly grown during kharif. Efficient irrigation techniques will contribute in saving ground water by 609.045 ham considering 50% of the sugarcane area is dependent on ground water irrigation and thus will improve stage of development marginally by 2.28%. However, in long run the practice of Efficient irrigation techniques will add to the ground water resource in large extent. **(Table-15)**.

**Table 15: Improvement in GW availability (2020) due to saving by adopting water use efficiency and artificial recharge**

Net annual ground water availability after implementation of AR	Existing gross ground water draft for all uses	Stage of ground water development after implementation of AR	Sugarcane grown area	Sugarcane area considered for WUE (50%)	Saving due to adopting WUE measures @ 0.57 m in sugarcane grown area	Cumulative annual ground water availability	Expected stage of ground water development after the implementation of WUE practices	Expected improvement in overall stage of ground water development
HAM	HAM	%	HA	HA	HAM	HAM	%	%
13907.82	3072.3	22.09	2137	1068.5	609.045	14516.865	21.16	13.92

## 4.3 Ground Water Development Plan

In Krishnarajpet taluk, the present stage of ground water extraction (2020) is merely **35.08 %** with net ground water availability of **8758.12** ham and total extraction of **3072.30** ham. The ground water draft for irrigation purpose is @ **2710.88** ham, thus indicating that ground water irrigation needs to be encouraged in the area. Also, the less ground water development is most probably linked to the low ground water potential areas and limited aquifer thickness in Aquifer-II. To overcome these conditions, it is imperative to have a robust ground water resource development plan for the area, 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 dugwells and Borewells.

In view of above, the focus of proposed ground water development plan is to up the ante of ground water development from the present 35% to 60% in a systematic way by adopting scientific approach. About 1145 dugwells (15-30 m depth; 3 to 5 m diameter @ Rs. 3.00 lakh/dugwell) are recommended to be constructed in feasible areas. Further 9644 borewells (40-100 m depth; 150 mm dia @ Rs. 2.00 lakh/borewell) are also recommended to be drilled in feasible areas. Additional irrigation potential which can be created considering crop water requirement of 0.65 m (Ha) will be **3358 ha**. The total expenditure proposed to be incurred will Rs. **75.74 Cr**. The detailed ground water development strategy to uplift the ground water use in the feasible areas is presented in **Table–16**.

**Table–16: Feasibility of additional GW abstraction structures based on GWRA 2020 availability**

Balance GWR available to make SOE 60%	DW unit draft	BW unit draft	No. of DW feasible @ 40% with unit draft of 1 ham	No. of BWs feasible @ 60% with unit draft of 1.25 ham	Cost of Proposed DW's/year @ unit cost of Rs. 3 lakhs	Cost of Proposed BW's @ unit cost of Rs. 2 lakhs	Additional irrigation potential created by DW's considering crop water requirement of 0.65 m (Ha)	Additional irrigation potential created by BW's considering crop water requirement of 0.65 m (Ha)	Total irrigation potential created by DW's and BW's
2182.57	1.3	0.44	1145	9644	1145	6429	336	3022	3358

*Note- Hydrogeological and scientific intervention is needed for pinpointing the sites for construction of dug wells and Bore wells*

#### 4.4 Change in cropping pattern

Change in cropping pattern is necessary since cultivation of water intensive crops like sugarcane is prevalent in the Taluk. Though only 2137 hectares is covered under sugarcane and paddy is also prevalent in the taluk, which covered 10372 hectare in Krishnarajpet taluk which can effect groundwater availability. At present (2020), the stage of ground water extraction is @ 35.08% and the taluk has been categorised as Safe, thus change in cropping pattern has not been suggested.

#### 4.5 Other interventions proposed

- Periodical maintenance of artificial recharge structures should also be incorporated in the Recharge Plan.
- Excess nitrate & fluoride 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 main ground water issues are Low Ground Water Development, Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, Deeper Water Levels particularly in Aquifer-II in some parts of areas which are all inter-related or inter dependent and poor ground water quality due to nitrate contamination in some pockets of the area. The summary of ground water management plan of Krishnarajpet taluk is given in **Table-17**.

**Table 17: Summary of Management plan of Krishnarajpet taluk**

Stage of GW Extraction and Category (2020)	35.08 %, Safe
Annual Extractable GW Resource (Ham)	8758.12
Total Extraction (Ham)	3072.30
Total GW Resources (Dynamic & Static up to the depth of 200 mbgl) (Ham)	9367.165
Ground Water Draft for Irrigation (Ham)	2710.88
<b>Ground Water Resource Enhancement by Supply side Interventions</b>	
No of Proposed AR structures	
SSD	2
PT	62
CD	300
Expected Additional Recharge to GW due to AR (Ham)	5149.7
Additional Irrigation Potential that can be created (Ha)	3358
Total Estimated Expenditure (Rs. in Cr.)	75.74
Change in Stage of GW Extraction (%)	35.08 to 22.09
<b>Ground Water Resource Savings by Demand side Interventions</b>	
Expected Saving due to adopting WUE measures in sugarcane area (Ham)	609
Change in Stage of GW development (%)	35.08 to 21.16
<b>Ground Water Resource Development Plan</b>	
Balance GWR available to enhance SOE 60% (Ham)	2182.57
No. of wells proposed	
<b>DW</b> – Depth: 15 to 30 m, Dia: 3 to 5 m, Unit Cost –Rs. 3.00 lakh, Av. Annual Gross draft – 1.3 ham	1145
<b>BW</b> – Depth: 40 to 100 m, Dia: 150 mm, Unit Cost – Rs. 2.00 lakh, Av. Annual Gross draft – 0.44 ham	9644
Additional irrigation potential created considering crop water requirement of 0.65 m (Ha)	3358
Total Estimated Expenditure (Rs. in Cr.)	31.95
Increase in Stage of GW Extraction (%)	35.08 to 60
<b>Ground Water Quality – Nitrate contamination</b>	Improving quality by proper drainage of sewage and Limited usage of Nitrogenous fertilizers

As per the resource estimation – 2020, Krishnarajpet taluk falls under Safe category with the stage of ground water extraction is 35.08 %. 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 ground water 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 68.66 MCM. This can be used to recharge the aquifer mainly through percolation tanks (62), check dams (300) and sub surface dyke structures (2). The volume of water expected to be conserved/recharged @75% efficiency is 35149.7 ham through these AR structures. The approximate cost estimate for construction of these AR structures is Rs. 42.74 Cr. The additional area which can be brought under assured ground water irrigation will be about 0.062 Lakh hectares.
- **Ground water resource enhancement by demand side interventions:** At present about 65 % 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 sugarcane crop which is grown in 2137 ha and considering 50% area is dependent on ground water irrigation, efficient irrigation techniques will contribute in saving ground water by 609 ham @ 0.57 m and thus will improve stage of development from 35.08 to 21.16 %. However, in long run the practice of efficient irrigation techniques will add to the ground water resource in large extent..
- **Change in cropping pattern:** Farmers are facing inadequacy of groundwater for agriculture during summer. Change in cropping pattern is necessary since cultivation of water intensive crops like sugarcane is prevalent in the Taluk. Though only 2137 hectares is covered under sugarcane and paddy is also prevalent in taluk, which covered 10372 hectare in Krishnarajpet taluk which can effect groundwater availability. At present (2020), the stage of ground water extraction is @ 35.08% and taluk has been categorised as Safe, thus change in cropping pattern has not been suggested.
- **Ground Water Resource Development Plan:** The present stage of ground water extraction (2020) is merely 35.08 % with net ground water availability of 8758.12 ham and total extraction of 3072.30 ham. The ground water draft for irrigation purpose is @ 2710.88 ham, thus indicating that ground water irrigation needs to be encouraged in the area. To overcome the low ground water development, it is imperative to have a robust ground water resource development plan for the area, which can be implemented in scientific manner. The implementation of the plan needs to

based on site specific detailed hydrogeological, geophysical and scientific surveys for pinpointing the sites for construction of dugwells and Borewells.

- In view of above, the focus of proposed ground water development plan is to up the ante of ground water development from the present 35% to 60% in a systematic way by adopting scientific approach. About 1145 dugwells (15-30 m depth; 3 to 5 m diameter @ Rs. 3.00 lakh/dugwell) are recommended to be constructed in feasible areas. Further 9644 borewells (40-100 m depth; 150 mm dia @ Rs. 2.00 lakh/borewell) are also recommended to be drilled in feasible areas. Additional irrigation potential which can be created considering crop water requirement of 0.65 m (Ha) will be 3358 ha. The total expenditure proposed to be incurred will Rs. 75.74 Cr.
- **Conjunctive use plan in water logged area:** An area of **650.48 sq.km** (65048ha) is covered by canal command area of Hemavathy project. Out of this area, an area of **15 ha** is water logged, and is reclaimed fully. (Source: CADA as on March 2021). In addition to this reclamation, conjunctive use plan is also recommended to benefit the water deficit and tail end area of the irrigation command.
- **Drinking water Supply:** In view of ground water contamination with mainly higher concentration Fluoride and Nitrate, 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.