केन्द्रीय भूमि जल 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

Channapatna Taluk, Ramnagara District, Karnataka

दक्षिण पश्चिमी क्षेत्र, बेंगलुरु
South Western Region, Bengaluru

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भारत सरकार
जल शक्ति मंत्रालय
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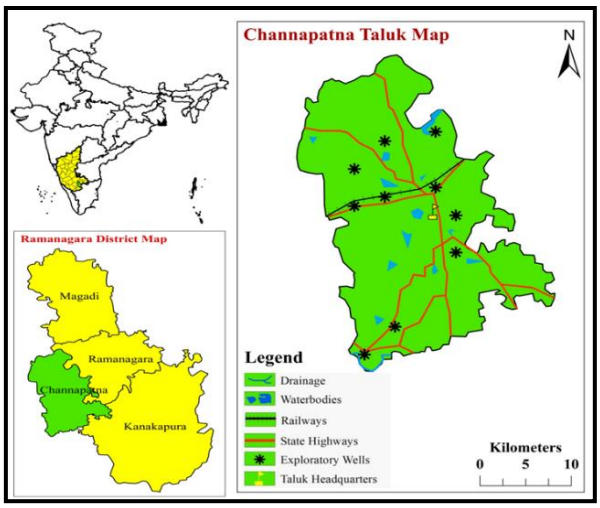
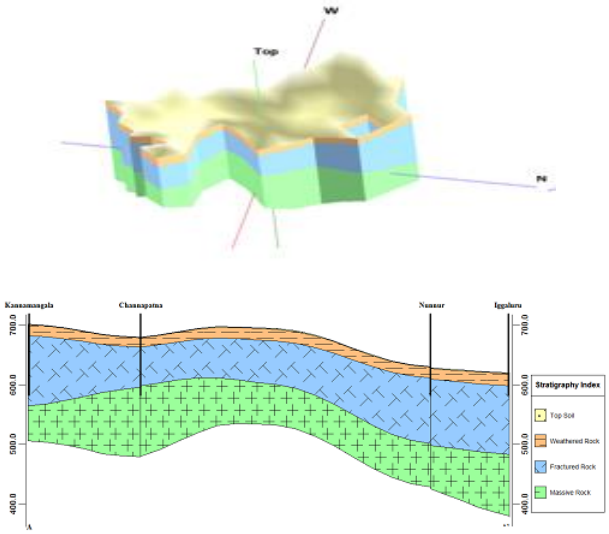
AQUIFER MAPS AND MANAGEMEN PLAN, CHANNAPATNA TALUK, RAMANAGARA DISTRICT, KARNATAKA STATE

(AAP: – 2020-2021)





By

S.SARITHA, Scientist 'B', CGWB, SWR, Bengaluru

JULY 2022

AQUIFER MAPS AND MANAGEMENT PLAN, **CHANNAPATNA** TALUK, **RAMNAGARA** DISTRICT, KARNATAKA STATE

(AAP: – 2020-2021)

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

1 SALIENT FEATURES

Name of the taluk	:	Channapatna
District	:	Ramanagara
State	:	Karnataka
Area	:	539 sq.km.
Population	:	261304 (2011 census)
Annual Normal Rainfall	:	854 mm

1.1 Study area

Aquifer mapping studies have been carried out in Channapatna taluk, Ramanagara district of Karnataka, covering an area of 541 sq.km under National Aquifer Mapping Project during AAP 2020-21. Channapatna taluk of Ramanagara district is located between North Latitudes 12o27'42" & 12o48'10" and East Longitudes 77o04'24" & 77o19'38". Channapatna is located on the Bangalore - Mysore highway. It is about 55 km from Bangalore and 80 km from Mysore. Channapatna is also called Town of toys. These toys are manufactured in traditional and advanced small-scale industries.

Channapatna taluk is bounded by Ramanagara and Kanakapura taluks in the east, Maddur taluk in the west, Kunigal taluk in northern side and Malavalli taluk in south. Administratively Channapatna taluk is divided into 3 Hoblies (Kasaba, Maluru & Virupakshipura), 32 Gram panchayats and 145 villages. Location map of Channapatna taluk of Ramanagara district is presented in **Fig.1.1** and the Gram Panchayat map of Channapatna Taluk is shown in **Fig 1.2**.

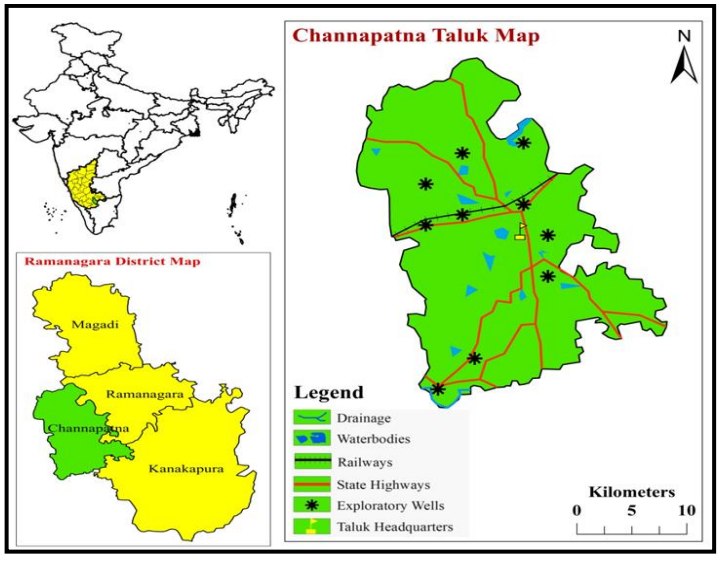


Fig.1.1: Location map of Channapatna Taluk

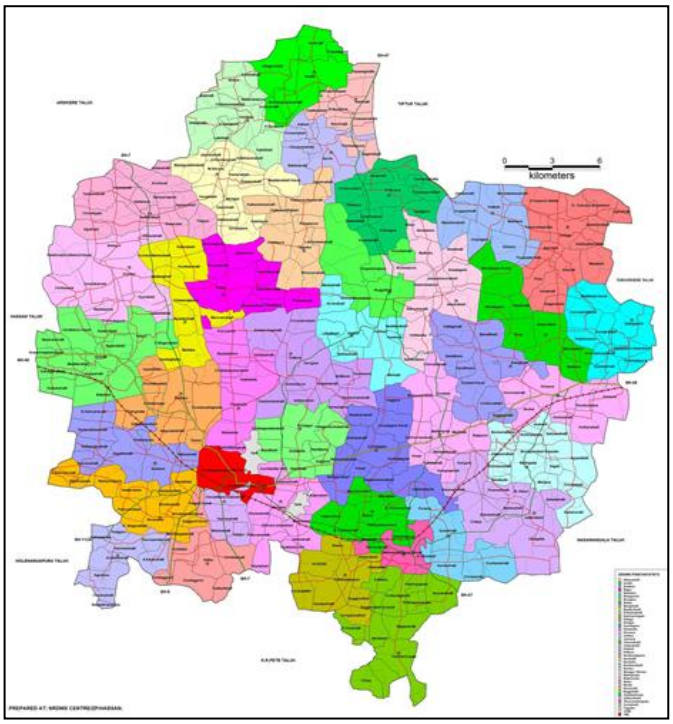


Fig. 1.2: Gram Panchayats of Channapatna Taluk

1.2 Population

According to 2011 census, the human population in Channapatna taluk is 261304 out of which 72% constitutes the rural population and only 28% constitute the urban population. The taluk has an overall population density of 485 persons per sq.km. In Channapatna taluk, the decadal variation in population from 2001-2011 is 3.46%. The population details are given in **Table-1.**

Table 1: Population details of Channapatna taluk

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 (%)
261304	130408	130896	24.14	189362	71942	3.46	0.19	13.16

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

1.3 Rainfall

The Channapatna 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 2019 & 2020 is given in Table 2a. Actual Monthly rainfall data is given in Table 2b.

Table 2a: Normal & Actual Rainfall of Channapatna Taluk

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
2019	184	145	423	474	236	250	843	854
2020	184	218	438	470	239	228	868	916

Source: KSNDMC, Karnataka

Table 2b: Actual monthly Rainfall (mm) of Channapatna Taluk

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2020	218					114	130	48	178	151	61	16	916
2021						61.2	104.2	77.4	119	225	191	58	

Source: KSNDMC, Karnataka

1.4 Agriculture & Irrigation

Agriculture is the main occupation in Channapatna taluk, since 72 % 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 to October) and Rabi season (Mid October to Mid-February). Major Kharif crops are paddy and vegetables. Main crops 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 2.33 and 3.74% respectively of the total crop area. However, paddy is grown during Kharif period and is mainly dependent on rain water. Ragi is grown in 44.51%, Maize in 3.41%, Fruits in 27.07%, Vegetables in 1.9% and Oil seeds grown in 2.31% of total crop area in the taluk. Bajra is grown in very small area of 7 ha (0.03%). Jowar, Wheat and Cotton are not grown in this taluk. **(Table 3)**

Table 3: Cropping pattern in Channapatna Taluk

Crop	Paddy	Maize	Bajra	Jowar	Ragi	Wheat	Pulses	Fruits	Vege tables	Oil seeds	Sugar cane	Cotton	Total crop
Area (ha)	778	711	7	0	9254	0	3053	5628	392	481	486	0	20790
Area %	3.74	3.41	0.03	0	44.51	0	14.7	27.07	1.9	2.31	2.33	0	100

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

About 11.5% of the geographical area is covered by forest. It is observed that net sown area accounts for 53.2% and area sown more than once is 4.72% of total geographical area in Channapatna taluk. Area not available for cultivation, the other uncultivable land and fallow land cover 15.74%, 7.65% and 11.96% respectively of total geographical area. About 69.16% 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 30.84%. Even though, irrigation tanks are present, the irrigation from tanks is not appreciable. 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 in Channapatna Taluk

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
53587	6131	8428	4098	6411	28519	2532	31051
% of the area	11.45	15.74	7.65	11.96	53.2	4.72	57.95

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

Table 5: Irrigation sources in Channapatna Taluk

ource of Irrigation	lo of tructures	ross area rigated (Ha)	et area rigated (Ha.)	of area
anals		565	425	5.15
anks	15	90	55	.74
Vells	086			
ore/Tube wells	2521	126	919	9.16
ft Irrigation		80	67	.95
ther Sources				
otal	4723	061	666	00.00

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

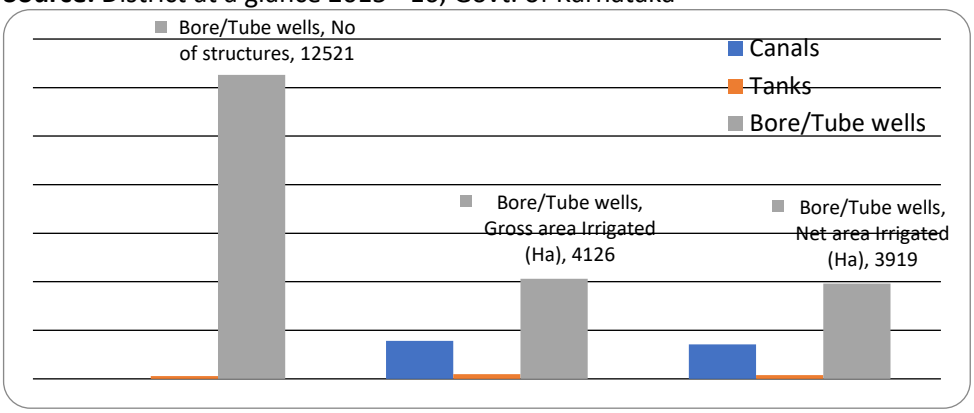


Fig 2: Irrigation Sources

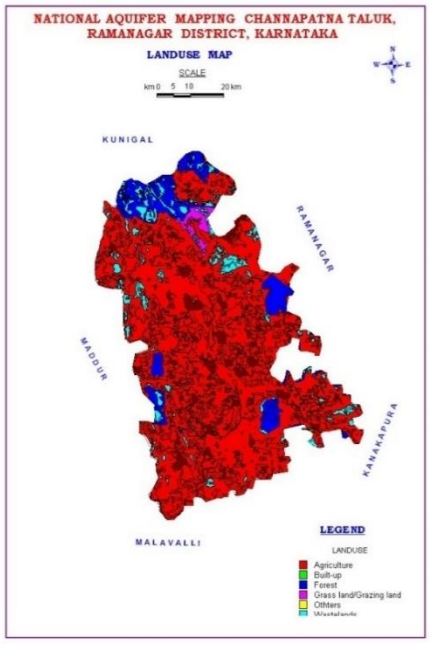


Fig.3: Landuse map

1.5 Geomorphology, Physiography & Drainage

The geomorphology of an area is the external appearance of landforms that gives a reliable picture of the underground strata and its physio-chemical condition. Channapatna taluk represents an uneven landscape with intermingling of hills and valleys **(Fig 4),** has an average elevation of 739 m. The major river is Cauvery and its main tributary is Shimsha river. Drainage map of the study area is presented in **Fig 5**.

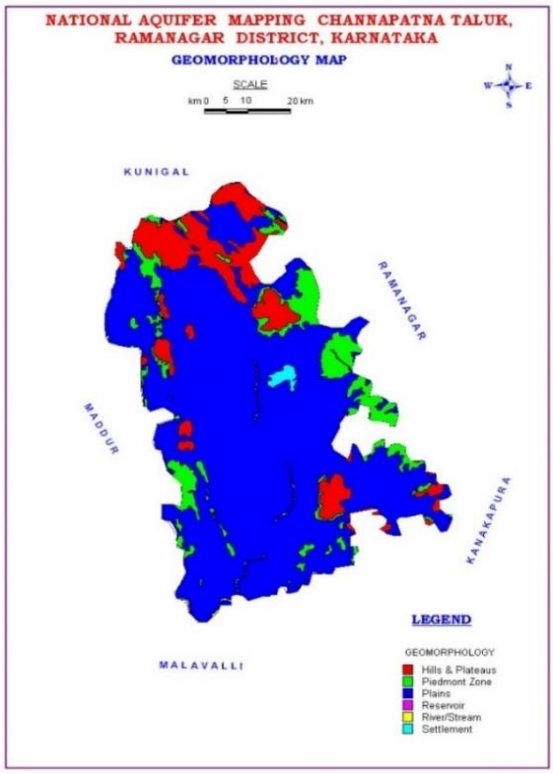


Fig. 4: Geomorphology Map

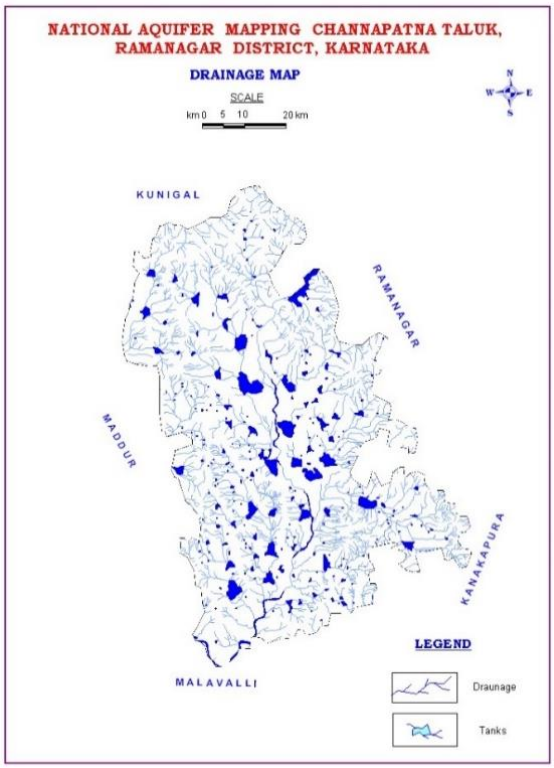


Fig. 5: Drainage Map

1.6 Soil

Soils play a major role in hydrologic control of the infiltrating water. Soils are generally classified by taking their color, texture, fertilities and chemical combinations includes salts, minerals and the solution effect over them. Channapatna taluk have sufficient organic carbon (>0.5%). The soils of the Channapatna taluk can be broadly grouped into red clayey soil. Soil map of the study area is presented in **Fig 6**.

1.7 Groundwater resource availability and extraction

Aquifer wise total ground water resources down to 200 m depth are given in **Table-6a** below as per 2017 estimation. The details of dynamic (Phreatic) ground water resources are shown in **Table.6b**

Table 6 a: Total Ground Water Resources, Belagavi taluk (as on March 2017 Figures in Ham)

Taluk	Annual Replenishable GW resources	Fresh In-storage GW resources		Total availability of fresh GW resources
		Phreatic	Fractured (Down to 200m)	Dynamic +phreatic in-storage + fractured
Channapatna	3841	5085	882	9808

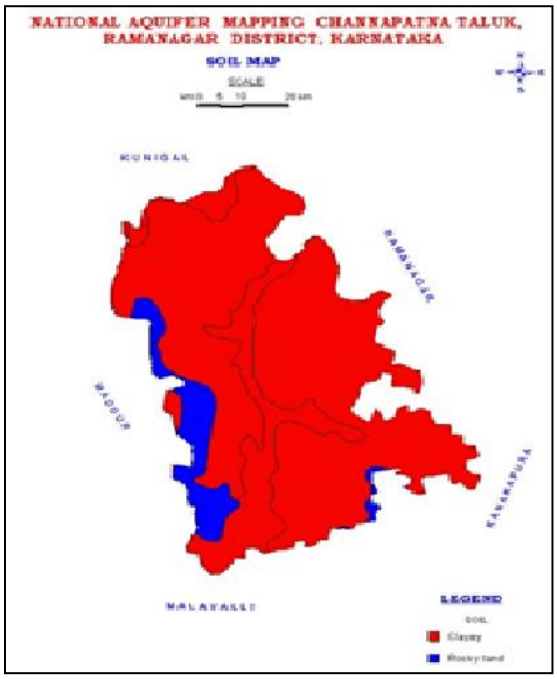


Fig. 6: Soil Map

Table.6 b: Dynamic Ground Water Resource, Channapatna taluk (2017 Figures in Ham)

Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross GW Draft for Domestic and Industrial Water Supply	Existing Gross Ground Water Draft for All Uses	Allocation For Domestic and Industrial Use for Next 25 Years	Net Ground Water Availability for Future Irrigation Develop-ment	Existing Stage of Ground Water Development	Category
3841	2856	207	3062	230	761	80	Semi Critical

1.8 Existing and Future Water Demands (as per GWRA-2017 and 2020)

As per the GWRA 2017, the net ground water availability is 3841 ham and the total ground water draft for all uses is 3062 ham with stage of development at 80% and the taluk falls in Semi-Critical category. Thus there is a less scope for future irrigation development @ 761 Ham. The domestic (Industrial sector) demand for next 25 years is estimated at 230 Ham.

The details of dynamic (Phreatic) ground water resources for Channapatna taluk as on March 2020 is shown in Table.6c. It is observed that the stage of ground water extraction is slightly gone down in the taluk from 80 % to 76.56 % from 2017 to 2020 with an increase in the net ground water availability during 2020 with a figure of 6832.44 Ham.

Table.6 c Detail of Dynamic Ground Water resource, Channapatna taluk (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)
6832.44	4914.24	0.00	316.49	5230.73	345.65	1572.56	76.56	Semi Critical

1.9 Hydrogeology

Aquifer I - The weathered thickness ranges from 2 m to 52 m. The premonsoon depth to water level ranges from 2 to 5 mbgl (GWD wells). CGWB is not having NHS dug wells in this taluk. Aquifers not sustainable for longer duration pumping and becomes desaturated.

Aquifer II- The major formations are fractured Granites and Gneisses. The pre-monsoon piezometric head ranges from 15 to 45 mbgl. The yield of the fractured aquifer ranges from 0.5 to 1.2 m^3/hr and sustainability is less than 1 hour. The Hydrogeology map of the Channapatna taluk is shown in **Fig 7.**

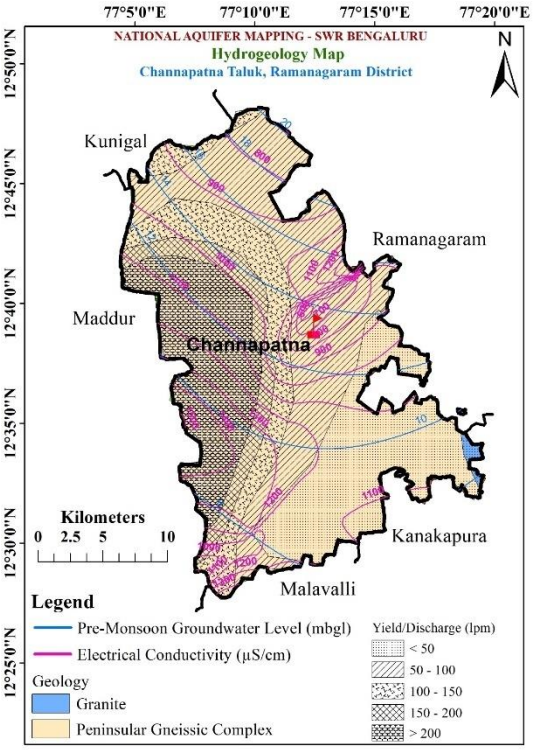


Fig.7: Hydrogeology map

1.9.1 Water level behavior

Depth to water level

Aquifer – I (Phreatic)

- Pre-monsoon: 0.5 – 5.62 mbgl **(Fig.8)**
- Post-monsoon: 1.80 - 9.80 mbgl **(Fig.9)**

During pre-monsoon, water level map shows that in 30% of the area, water level ranges between 0 to 2 mbgl, in 60 % of the area, water level ranges between 2 to 5 mbgl and in 10% of the area, water level is greater than 5 mbgl. During post monsoon, water level map shows that in 25 % of the area, water level ranges in between GL and 2mbgl, in 70 % of the area, water level ranges in between 2 and 5 mbgl and 5% of the area shows greater than 5 mbgl.

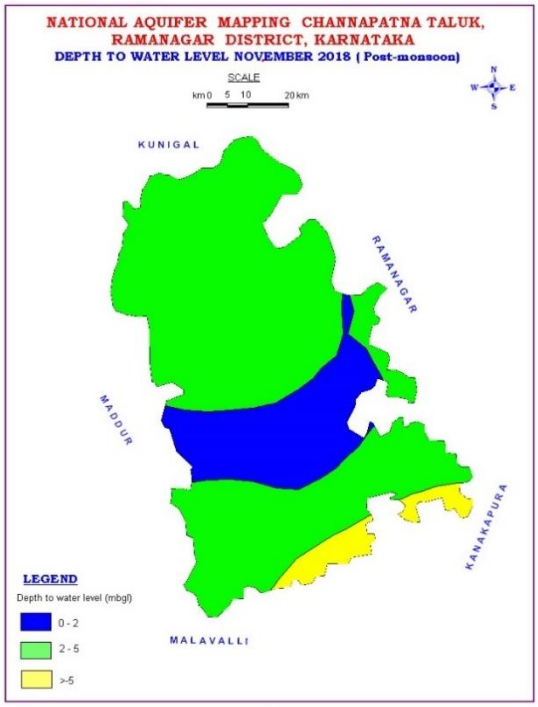


Fig. 8: Pre-monsoon DTW (May 2018)

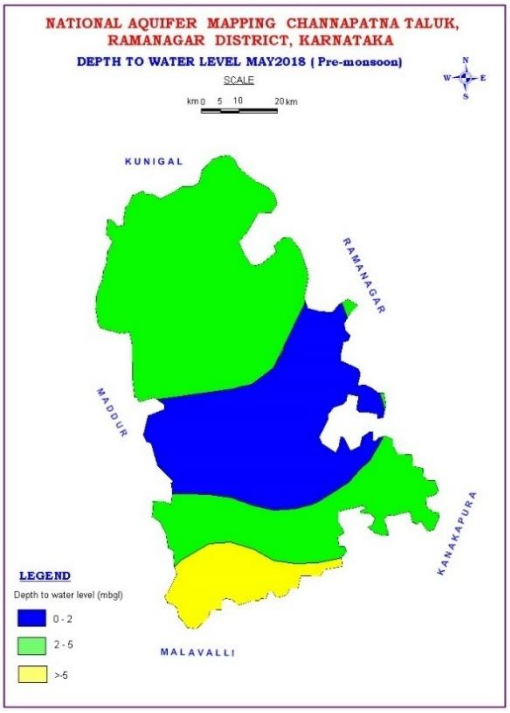


Fig. 9: Post-monsoon DTW (Nov 2018)

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 is 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 Channapatna taluk, there are two types of aquifer systems;

i. **Aquifer-I (Phreatic aquifer)** comprising weathered Granite and banded gneissic complex

ii. **Aquifer-II (Fractured aquifer)** comprising Fractured Granite and banded gneissic complex

Geologically, Channapatna taluk is predominantly underlain by granites and gneisses of Achaean age, popularly designated as hard rocks. These gneisses are often found to be intruded by basic dykes. The dominant strike direction is northwest – southeast with a subsidiary east-north-east strike. These hard rocks are fractured and fissured and have undergone extensive and chemical decomposition in the plains and valleys. The resulting weathered mantle ranges in thickness generally from 10 to 50 meters.

In Channapatna taluk, fractured Granite and Gneiss are the major water bearing formations **(Fig.10)**. Groundwater occurs within the jointed and fractured Granite and Gneiss under semi-confined to confined conditions. 8 Exploratory bore wells were drilled in this Taluk during 1991 to 1993 from a

minimum depth of 33 mbgl to a maximum of 225 mbgl. Depth of weathered zone (Aquifer-I) ranges from 10 to 58mbgl **(Fig.11)**.

Ground water exploration reveals that aquifer-II fractured formation was encountered between the depth of 14 to 128 mbgl. Yield ranges from 0.4 to 4.5 lps. The details of the Exploratory wells drilled by CGWB are given in **Table 7** and details of Exploratory wells drilled by State Rural drinking water supply dept, Karnataka is given in **Annexure I.**

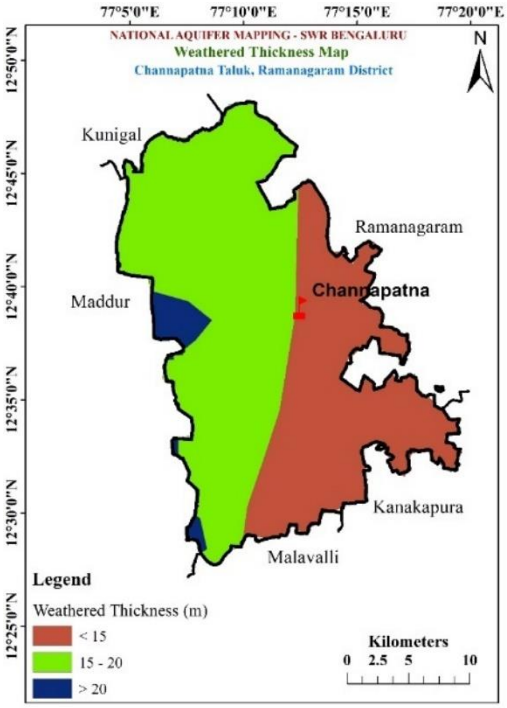


Fig 10: Geology Map

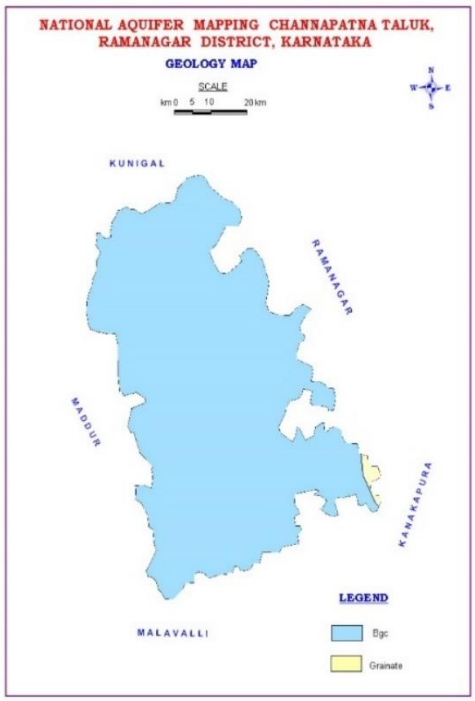


Fig 11: Weathered Thickness Map

The 3D Aquifer disposition models, 2D aquifer sections and 3D aquifer fence diagrams have been prepared and presented in **Fig. 12a, b & c.**

Table 7: Details of Ground water Exploration in Channapatna Taluk

S. No.	Location	Lat	Long	Depth drilled (mbgl) / Casing (m)	Lithology	Fracture Zones encountered (mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2/day)
1	Byrapatna	12.641	77.1333	128.52 / 16	Granite gneiss	14.62-15.24, 40.7-42.7, 80.8-82.80, 128.20-128.52	10.5	11.29	35.9	7.4
2	Byrapatna	12.641	77.1333	99.59 / 20.6	Granite gneiss	18-20, 80	8.15	3.7	33.37	
3	Channapatna	12.658	77.2083	225 / 14.62	Granite gneiss	19, 130	15.354	0.96		6
4	Nunnur	12.509	77.1694	200 / 15	Granite gneiss	30-31, 35-41	20.045	6.09	7.8	95
5	Nunnur	12.509	77.1694	48	Granite gneiss	31-33	19.565	0.43		
6	Nunnur	12.509	77.1694	48	Granite gneiss	29-31	19.975	0.31		
7	Sogala	12.645	77.1625	140	Granite gneiss	24-24.5,	18.3	3	6.19	34

S. No.	Location	Lat	Long	Depth drilled (mbgl) / Casing (m)	Lithology	Fracture Zones encountered (mbgl)	SWL (mbgl)	Discharge (lps)	Drawdown (m)	T (m^2/day)
						27-28, 29-30, 40-45, 106-108, 108-110				
8	Sogala	12.645	77.1625	175.86	Granite gneiss	26-28, 28-30, 96-97	16.7	4.5	6.4	54
9	Sogala	12.645	77.1625	33	Granite gneiss		16.988	0.96		
10	Sogala	12.645 833	77.1625	33.08	Granite gneiss		16.92	0.58		

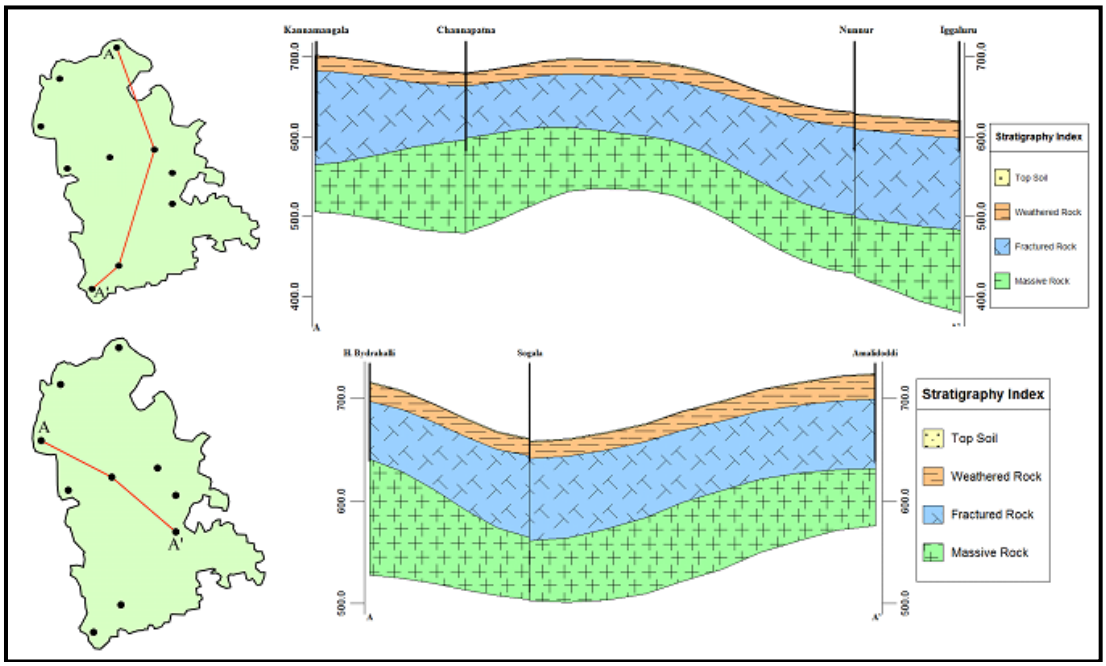
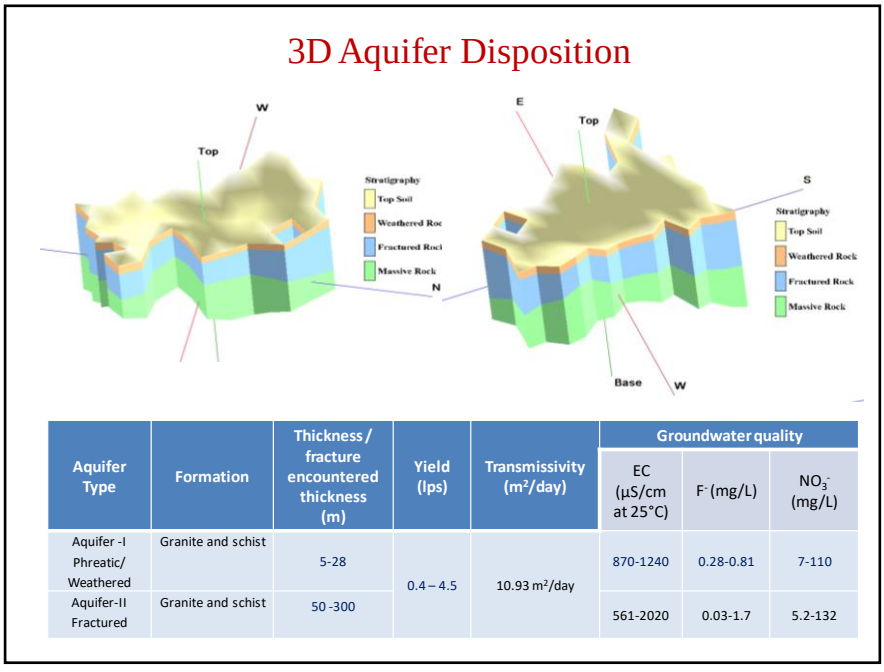


Fig 12 a: 2D Aquifer Sections



Aquifer Type	Formation	Thickness / fracture encountered thickness (m)	Yield (lps)	Transmissivity (m^2/day)	Groundwater quality		
					EC (µS/cm at 25°C)	F^- (mg/L)	NO_3^- (mg/L)
Aquifer -I Phreatic/ Weathered	Granite and schist	5-28	0.4 – 4.5	10.93 m^2/day	870-1240	0.28-0.81	7-110
Aquifer-II Fractured	Granite and schist	50 -300			561-2020	0.03-1.7	5.2-132

Fig 12 b: 3D Aquifer Disposition

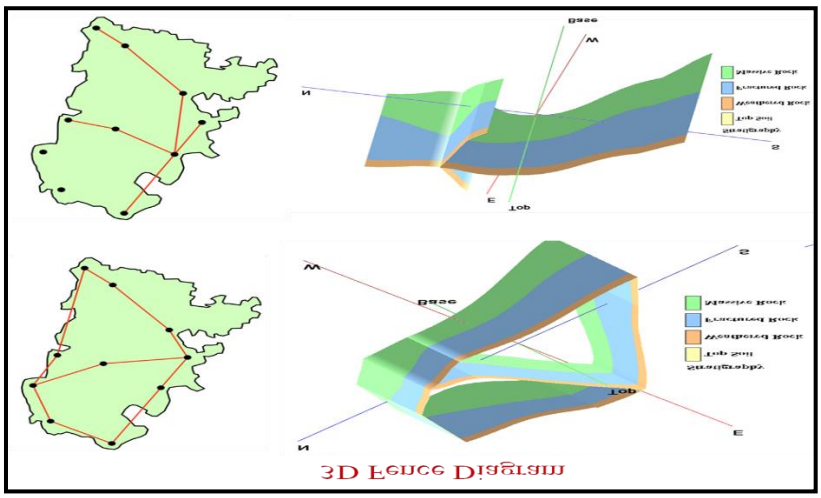


Fig 12 c: 3D Aquifer Fence Diagram

3 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

The main ground water issues are Limited Ground Water Potential / Limited Aquifer Thickness / Sustainability, over-exploitation and declining water level trend which are all inter-related or inter dependent.

3.1 Aquifer wise groundwater resource availability and extraction

As on March 2020, the ground water availability has almost doubled when compared with the previous GW resource estimation resulting in lowering of stage of extraction. It may be due to heavy rainfall and implementation of artificial recharge structures in the taluk.

Table 8: Present Dynamic Ground Water Resource (ham) in Channapatna taluk (2017 and 2020)

Assessment year	Net annual ground water Availability	Existing gross ground Water draft for irrigation	Existing gross ground Water draft for domestic And industrial water supply	Existing gross ground Water draft for all uses	Allocation for domestic And industrial use for next 25 years	Net ground water Availability for future Irrigation development	Existing stage of ground Water development %	Category
As on March 2017	3841	2855	207	3062	230	761	80	Semi critical
As on March 2020	6832	4914	316	5231	346	1573	77	Semi critical

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

Taluk	March 2017			March 2020		
Channapatna	GW availability	GW Extraction	Stage of GW development	GW availability	GW Extraction	Stage of GW development
	3841	3068	80%	6832	5231	77%

3.2 Chemical quality of ground water and contamination

To evaluate the quality of ground water, water samples have been collected from borewells and dugwells of Channapatna Taluk during December 2020 and were analysed for major chemical constituents at Chemical laboratory in CGWB, SWR, Bangalore. Suitability of ground water for domestic purposes was evaluated with the concentration ranges recommended by IS: 10400, BIS, 2012 and ICMR drinking water standards and presented in **Table10**a & b.

Table 10 a: Hydro chemical data of Borewell samples

S. No.	Location	pH	EC µS/cm	TH	Ca	Mg	Na	K	HCO_3	Cl	SO4	NO_3	F
				<.....mg/L.....>									
1	Rampur	7.45	1832	465	90	58.08	209	6.4	439	209	167	124	ND
2	Dasegowdanadoddi	7.3	1610	425	88	49.61	169	10	336	236	106	132	1.70
3	H.Byadarahalli	7.36	700	220	48	24.2	58	3.2	226	95	42	10	1.10
4	Mathikere	7.56	2020	530	124	53.24	220	2.8	405	327	116	77.6	0.44
5	Malurpatna	7.65	1620	440	88	53.24	160	14.8	356	252	124	33.6	0.03
6	Akkur	7.49	1133	350	46	56.87	82	18	297	156	56	50	ND
7	Virupakshipura	7.35	561	170	28	24.2	49	4	195	50	25	5.2	ND
8	Tagachakere	7.89	1332	400	74	52.03	94	6.4	342	188	94	16.8	1.06

ND – Not detected

Table 10 b: Hydro chemical data of Dugwell samples

S. No.	Village	pH	EC µS/cm	Cl	NO_3	F
				<.....mg/L.....>		
1	Chennapatna	8.2	1080	90	7	0.43
2	Yelekere	7.42	1840	192	10.4	ND
3	Nunnuru	7.99	990	78	12	0.28
4	Malagalu	8.05	1240	113	110	0.66
5	Kengal	7.94	870	63	11	0.81

Chemical analytical data of dugwells/borewells samples collected by Ground Water Directorate; Govt. of Karnataka during 2018-19 from Channapatna Taluk is presented in **Table 10 c**.

Table 10 c: Hydro chemical data of Dug well/Borewell samples

Sl. No.	Village	Latitude	Longitude	Fe mg/L	F mg/L	NO_3 mg/L	TH (as $CaCO_3$) mg/L
1	K.H. Gudi	77 14 10	12 41 18	0.03	0.55	5	396
2	Channapatna	77 12 10	12 39 10	0.02	0.38	3	180
3	Mathigere	77 16 40	12 38 15	0.02	1.81	7	368
4	B.V. Halli	77 15 30	12 35 10	0.03	0.5	27	652
5	Virupakshipura	77 13 15	12 34 45	0.02	2.24	8	476
6	Nunnuru	77 09 57	12 30 36	0.04	1.79	8	468

Source: GWD. Govt. of Karnataka

The electrical conductivity in water samples is an indication of total dissolved ions. Thus, 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 (561-1832 µS/cm at 25˚ C) **Fig 13.1**. 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 25^0C) can be extended to a TDS of 2000mg/l (corresponding to about 3000 μS/cm at 25^0C) in case of an alternate source. Water samples having TDS more than 2000mg/l are not suitable for drinking purpose**.**

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. However, continuing consumption of higher concentrations, above 1.2mg/l however cause dental fluorosis and in extreme cases even skeletal fluorosis. Most of the fluoride found in groundwater is of geogenic origin. Distribution of fluoride in the taluk ranges from 0.03 mg/l to 1.5 mg/l **(Fig 13.2)**. In some villages fluoride is more than 1.5 (marked with red colour). Thus, majority of samples in the taluk shows fluoride concentration below 1.5 mg/l rendering them suitable for drinking purpose**.**

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 3 mg/l to 132 mg/l **(Fig 13.3)**. Nitrate in drinking water should not exceed 45 mg/l as per BIS (ISO: 10500: 2012) standard**.**

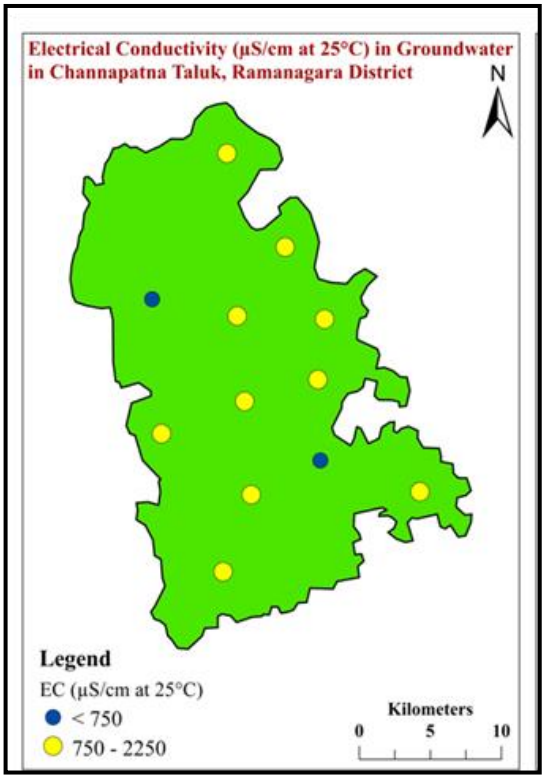


Fig 13.1: Distribution of EC

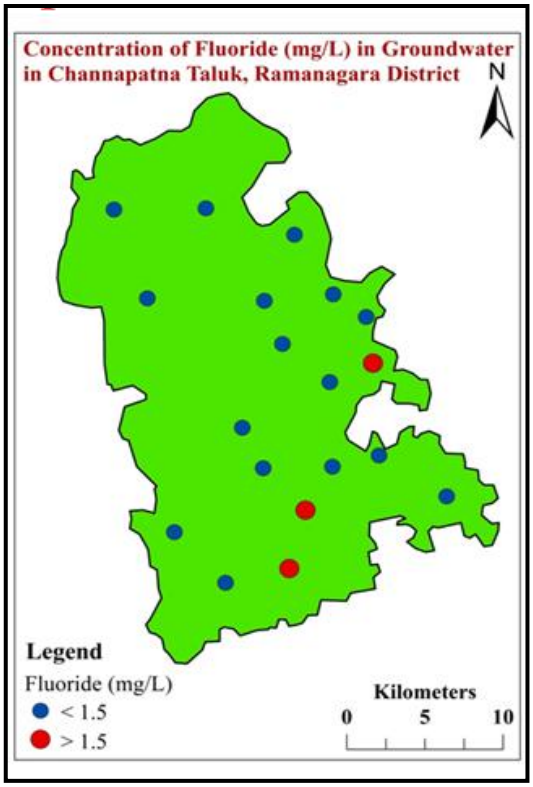


Fig 13.2: Distribution of fluoride

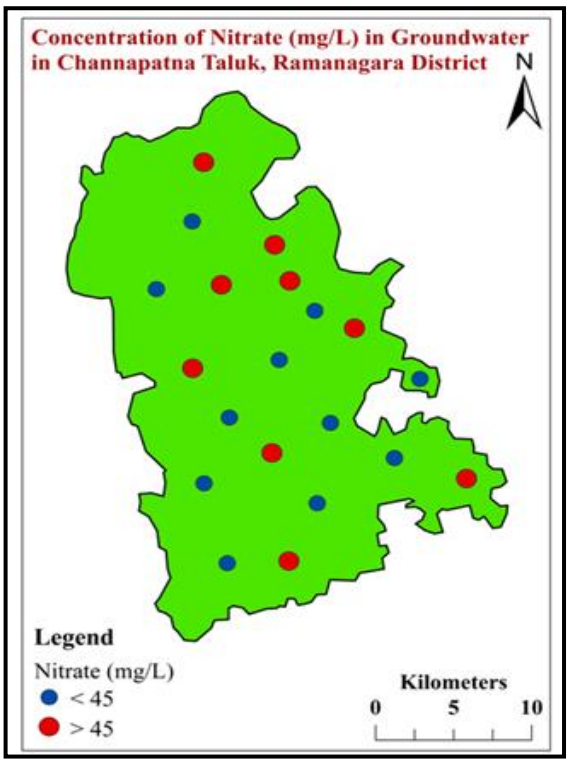


Fig 13.3: Distribution of Nitrate

4 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANAGEMENT STRATEGY

4.1 Resource Enhancement by Supply Side Interventions

Recharge phreatic aquifer (Aquifer-I) in the taluk, through construction of artificial recharge structures, viz. Check dams, percolation tanks & point recharge structures. 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. The tentative locations of proposed artificial recharge structures in Channapatna taluk is shown in **Fig.14** and the list is given in **Annexure-II.** Artificial Recharge and Water Conservation Plans are proposed in the taluk through utilizing the uncommitted surface runoff of 5.370 MCM **(Table 11).** By constructing 5 percolation ponds in the taluk, 0.005 lakhs hectares of additional irrigation potential can be created. The existing 77% of stage of ground water extraction would reduce to 71% **(Table 12)**.

Table 11. Groundwater Management-Master plan (2020) for Artificial Recharge to Groundwater

Artificial Recharge Structures Proposed and constructed	ChannapatnaTaluk
Area Feasible for Artificial Recharge (Ha)	28000
Non committed monsoon runoff available (Ham)	5.370
Number of existing Check Dams	67
Number of existing Point Recharge Structures	4
Number of Check Dams proposed	0
Number of Percolation Tanks proposed	5
Number of Sub Surface Dyke proposed	0
Tentative total cost of the project (Rs.in lakhs)	96.66
Excepted recharge (MCM)	5.370

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

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	Additional potential from proposed irrigation development schemes through inter-basin transfer	Cumulative annual ground water availability after implementation of AR structures	Expected improvement in stage of ground water extraction after the implementation of the project
HAM	HAM	%	HAM	HAM	HAM	%
6832	5231	77	537	-	7369	71

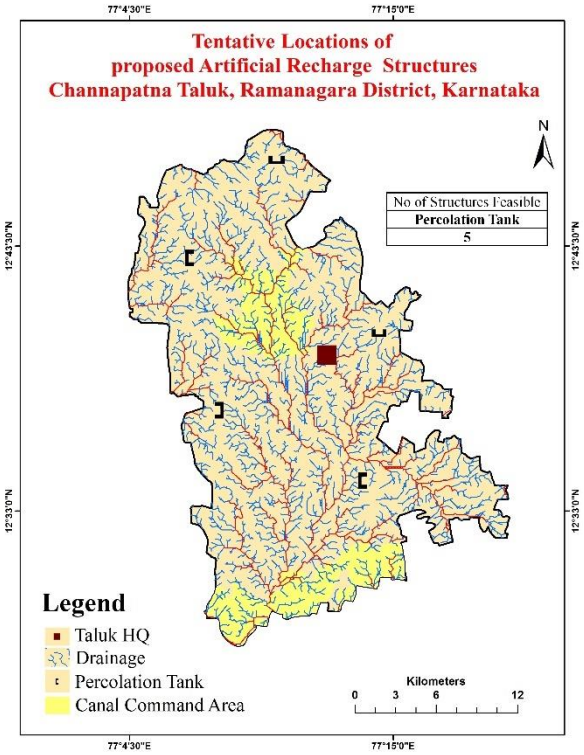


Fig 14: Tentative Proposed Locations of Artificial Recharge Structures

4.2 Resource Savings by Demand Side Interventions

It is observed that presently 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. About 4914 ham of ground water is utilized for irrigation practices and it contributes about 80% of the total irrigated area and hence requires optimal management plans to utilise the available resource.

Efficient irrigation practices like Drip irrigation and Sprinkler have to be adopted by the farmers in the existing 5666 ha of gross irrigated area. Presently, draft through irrigation is 4914 ham. Implementation of adopting grey water will contribute in saving ground water by 158 ham and will improve stage of development by 3% from 71% to 69% **(Table13).**

Table 13: Details of resource enhancement after proposed supply side and demand side interventions

Sl. No.	**Resource Details**	**As per 2020 Estimation**
1	Net Ground Water Availability in Ham	6832
2	Existing ground water draft for all uses in Ham	5231
3	Existing Stage of Ground Water Development in percentage %	77
	Resource Enhancement by Supply Side Interventions	
4	Expected Recharge from Artificial Recharge sources	537
5	Cumulative Ground water availability in Ham	7369
6	Expected improvement in stage of ground water development %	77 to 71
	Resource Enhancement by Demand Side Interventions	
7	Saving due to adopting grey water in Ham (50% of Domestic Extraction)	158
8	Cumulative ground water availability after adopting WUE and Grey water in Ham	7527
9	Expected improved stage of ground water development after implementation of Grey water %	71 to 69

4.3 Regulation and Control

Channapatna taluk has been categorized as Semi critical, since the stage of ground water extraction has reached 77% (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.

4.4 Other interventions proposed:

- The filling of existing irrigation tanks with water from Shimsha (Water from Iggalur Barrage) **Photo 1** covering the parched area has shown the built-up in ground water levels and has resulted in sustainability of the aquifers. It is recommended to upscale such activities to improve ground water potential.
- Adaptive management strategies -Water use efficiency methods, Changing of Cropping patters etc. Adoption of improved methods of irrigation such as drip would not only save water, power, fertilizer consumption, weeding cost but also helps in controlling environmental degradation. Growing drought tolerant crops like Ragi, Tur, Avare, cowpea, Horsegram, Castor, Niger etc., is recommended as a mitigate measure**.**
- Remedial measures need to be adopted in the areas affected by Fluoride, Nitrate and EC through artificial recharge and water conservation etc.
- The choice of recharge structures should be site specific and such structures need to be constructed in areas already identified as feasible for artificial recharge.
- Augmenting surface water supply from Cauvery River.
- Intense monitoring of water level is recommended to keep an eye on water level trend in the Taluk.
- Enhance recharge of aquifers and introduce sustainable water conservation practices
- Recharge and run off control measures to improve ground water recharge so as to create opportunities for farmer to access recharged water through shallow tube/dug wells
- Promoting efficient water conveyance and field application devices within the farm viz., underground piping system, Drip & Sprinklers
- Encouraging community irrigation through registered user groups
- Farmer oriented activities like capacity building, public interaction programmes training etc

Photo 1: Filling of existing irrigation tanks with water from Shimsha(Iggalur Barrage) at Garkahalli, Harekoppa GP, Channapatna Taluk

5 SUMMARY AND RECOMMENDATIONS

The summary of Management plan of Channapatna taluk is given in **Table-14.**

Table-14: Summary of Management plan of Channapatna taluk

Stage of GW Extraction and Category (2020)	77%, Semi-Critical
Annual Extractable GW Resource (Ham)	6832
Total Extraction (Ham)	5231
Total GW Resources (Dynamic & Static up to the depth of 200 mbgl) (Ham) as on 2017	9808
Ground Water Draft for Irrigation (Ham)	4914.24
Area Feasible for Artificial Recharge (Ha)	28000
Ground Water Resource Enhancement by Supply side Interventions	
No of Proposed AR structures SSD PT CD	 0 5 0
Expected Additional Recharge to GW due to AR (Ham)	537
Additional Irrigation Potential that can be created (Ha)	500
Total Estimated Expenditure (Rs. in Cr.)	0.96
Change in Stage of GW Extraction (%)	77 to 71
Ground Water Resource Savings by Demand side Interventions	
Expected Saving due to Grey water use (Ham)	158
Change in Stage of GW development (%)	71 to 69
Excess Nitrate concentration	Dilution of nitrate rich ground water through artificial recharge & water conservation.

	Roof top rain water harvesting Improving quality by controlling usage of Nitrogenous fertilizers in agriculture field and maintaining the proper domestic drainage network system
Excess Fluoride concentration	Alternate source Removal technology
Water Use efficiency measures	Government to take initiative to encourage at least 70% farmers to adopt water use efficiency irrigations practices like dip & sprinkler irrigation

Apart from the above, the following management aspects are also recommended for maintaining ground water sustainability in the taluk.

- **Change in cropping pattern:** Farmers are facing inadequacy of groundwater for agriculture. Hence, change in cropping pattern and water economy irrigation practices are recommended. Farmers can opt for more rain-fed millets and water efficient Pulses for agricultural production. This needs active support from Government.

- **Drinking water Supply:** In view of ground water contamination with higher concentration of Nitrate and Fluoride, identification of contamination free ground water source is essential. Alternatively, drinking water supply from surface water source needs to be covered at large.

- **Other Interventions proposed:** Construction of rain water harvesting units at the household level are also recommended.

- **Participatory management:** Awareness programmes and practice of participatory approach needs to be strengthened with the involvement of all the stake holders for sustainable ground water management.

- **Water Linkages with other Activities:** Water sector has strong linkages with other developmental activities. Hence, the proposed management plans cannot be considered as static and needs to be reviewed and improved from time to time.

Annexure I: Details of Borewells in Channapatna Taluk drilled by Rural Water Supply Dept, Govt. of Karnataka

S. No	Village	Date of Drilling	Total depth	Depth of Casing (mbgl)	Depth of water	Yield (GPH)
1	Nunnuru	18-11-2016	270	25	250-350	1000
2	Iggaluru	21-11-2016	255	23	250-350	1200
3	Banagahalli	21-11-2016	300	22	250-350	1400
4	Kalikere	21-11-2016	300	24	250-350	800
5	nagapura	21-11-2016	260	25	250-350	800
6	PWD quaruss	21-11-2016	260	20	250-350	800
7	Honnayakanahalli	07-01-2017	310	20	250-350	600
8	Guddehosuru	07-01-2017	265	24	250-350	1000
9	Garakalli	11-01-2017	280	23	250-350	1000
10	Avverahalli	11-01-2017	270	23	250-350	1000
11	Harokoppa	11-01-2017	250	22	250-350	1400
12	Sogala	11-01-2017	255	25	250-350	1200
13	Bramanipura	10-03-2017	300	25	250-350	800
14	Thagachagere	10-03-2017	290	24	250-350	1000
15	Honganuru	10-03-2017	270	23	250-350	1000
16	Mehandinagara	14-03-2017	275	24	250-350	1400
17	Honnayakanahalli	14-03-2017	300	25	250-350	1000
18	Mole	14-03-2017	260	24	250-350	1500
19	Mahadeswara nagara	28-03-2017	280	23	250-350	1000
20	Charch Road	28-03-2017	290	25	250-350	800
21	Mankunda	28-03-2017	265	23	250-350	1200
22	Huluvadi	28-03-2017	270	23	250-350	1300
23	Sulleri	29-03-2017	280	24	250-350	1000
24	Maregowdanadoddi	29-03-2017	270	25	250-350	1400
25	Nunnuru	30-03-2017	280	24	250-350	1000
26	madapura	30-03-2017	270	25	250-350	1400
27	Neraluru	30-03-2017	280	25	250-350	800
28	Harisandra	30-03-2017	290	24	250-350	1000
29	Polidoddi	30-03-2017	300	25	250-350	800
30	Rampura	30-03-2017	300	25	250-350	1000
31	Kannamangala	30-03-2017	290	24	250-350	1200
32	Devarahosahalli -1	30-03-2017	300	25	250-350	800
33	Devarahosahalli -2	30-03-2017	290	24	250-350	1000
34	Keremegaladoddi	30-03-2017	280	24	250-350	800
35	Sunnaghatta	30-03-2017	275	23	250-350	1000
36	Maluru	10-03-2017	265	22	250-350	1200
37	Byrapatna	14-03-2017	285	20	250-350	1200
38	Byrapatna janatha colony	14-03-2017	280	22	250-350	1400
39	Maluru	28-03-2017	270	20	250-350	800
40	Tubinakere	18-03-2017	285	23	250-350	900
41	Kukkuru	18-03-2017	270	25	250-350	1000
42	Chakkere	20-03-2017	290	25	250-350	900
43	Belakere	20-03-2017	265	23	250-350	1200
44	Seebanahalli	22-03-2017	300	25	250-350	600
45	Mudagere	30-03-2017	290	24	250-350	900
46	Mudagere	30-03-2017	290	23	250-350	1200
47	Sankalagere	18-03-2017	270	25	250-350	1200

48	Kunturudoddi	18-03-2017	240	25	250-350	1000
49	Dashavara	21-03-2017	270	25	250-350	1200
50	Menasiganahalli	13-01-2017	290	23	250-350	800
51	Menasiganahalli	13-01-2017	290	23	250-350	800
52	Yaliuru-1	18-01-2017	300	22	250-350	800
53	Yaliuru-2	18-01-2017	290	20	250-350	600
54	Jagadapura	21-01-2017	280	23	250-350	1200
55	Siddapura-1	28-01-2017	290	20	250-350	600
56	Siddapura-2	28-01-2017	300	18	250-350	600
57	Samandipura	03-03-2017	290	25	250-350	1000
58	Samandipura	03-03-2017	275	23	250-350	800
59	Y T halli	18-03-2017	270	22	250-350	1200
60	Dyavapatna	18-03-2017	290	20	250-350	1000
61	Aralalusandra-1	21-03-2017	290	23	250-350	1200
62	Aralalusandra-2	21-03-2017	290	21	250-350	900
63	Virupasandra	18-03-2017	270	25	250-350	1000
64	Ramegowdanadoddi	18-03-2017	250	25	250-350	800
65	Syanubhoganahalli	18-03-2017	275	23	250-350	800
66	Lambanithandya	09-08-2017	290	24	250-350	1200
67	Byrapattana	26-11-2017	270	21	250-350	1000
68	singarajipura	12-11-2017	275	23	250-350	1400
69	Bukkasagara	09-08-2017	290	22	250-350	900
70	Harokoppa	10-10-2017	270	22	250-350	1400
71	Doddanahalli	10-10-2017	295	23	250-350	800
72	Ambadahalli	02-06-2017	280	25	250-350	1200
73	Nelamakanahalli	01-01-2018	275	23	250-350	900
74	Yalachipalya	18-02-2018	292	23.5	250-350	800
75	Akkur	16-02-2019	270	23	250-350	800
76	Menasiganahalli	18-01-2019	300	25	250-350	600
77	Garakahalli	26-12-2018	297	24.5	250-350	1000
78	Harokoppa	27-12-2018	312	25	250-350	1200
79	Iggaluru	21-12-2018	308	20	250-350	1200
80	Veeregowdana doddi	21-12-2018	270	24	250-350	800
81	Chikka boregowdana doddi	21-12-2018	313	25	250-350	600
82	Neraluru	31-12-2018	290	24	250-350	1200
83	Yaliyur (**2 borewells)**	18-02-2019	290	23	250-350	1000
84	Mandya bommanayakanahalli	23-01-2019	290	23	250-350	800
85	Halemoledoddi	15-02-2019	280	24	250-350	1000
86	Doddanahalli	14-02-2019	300	23	250-350	600
87	Paredodi	29-12-2018	280	25	250-350	1200
88	Singarajapura	23-01-2019	275	23	250-350	1200
89	Brahmanipura	25-01-2019	271	22	250-350	1000
90	Thimmasandra	25-01-2019	290	25	250-350	600
91	Thagachakere	25-01-2019	290	24	250-350	1000
92	Chandragiri doddi	15-02-2019	280	23	250-350	1200
93	Vandaraguppe	23-01-2019	275	24	250-350	1000
94	Somanathapura	15-02-2019	270	23	250-350	1000
95	Hosakanni doddi	15-02-2019	280	21	250-350	1000
96	Mahadi	08-02-2019	290	23	250-350	800
97	Nelamakanahalli	08-02-2019	295	25	250-350	800
98	Virupakshipura	08-02-2019	275	23	250-350	1200

99	Chakkere	08-02-2019	283.5	24	250-350	1600 GPH
100	Banagahalli	16-02-2019	280	24	250-350	1200
101	Honnanayakanahalli	23-01-2019	300	24	250-350	1000
102	Mylanayakanahalli	23-01-2019	275	23	250-350	1200
103	Nagapura	29-12-2018	270	25	250-350	1200
104	Nunnuru	28-12-2018	280	24	250-350	1000
105	Chikka boregowdana doddi	08-01-2019	280	23	250-350	1000
106	Aralalusandra	08-01-2019	290	21	250-350	1200
107	Byrashettihalli	08-01-2019	270	23	250-350	1400
108	Hosakanni doddi	08-01-2019	290	25	250-350	1000
109	Dyavapatna	08-01-2019	270	23	250-350	1300
110	Banduru valagerepalya	08-01-2019	270	25	250-350	1200
111	Bukkasagara	08-01-2019	295	21	250-350	800
112	Lambani thandya	27-12-2018	300	22	250-350	1400
113	Menasiganahalli	28-12-2018	290	23	250-350	900
114	Jagadapura	26-12-2018	270	25	250-350	1200
115	Kallapura	28-12-2018	275	22	250-350	800
116	Karekoppa	26-12-2018	280	22	250-350	900
117	Guvvapura	28-12-2018	290	20	250-350	600
118	Yaliyur	26-12-2018	290	23	250-350	800
119	Shanubhoganahalli	28-12-2018	270	21	250-350	900
120	Singarajapura	26-12-2018	270	22	250-350	1200
121	Anchipura	28-12-2018	265	23	250-350	1400
122	Bananthahalli	26-12-2018	270	21	250-350	1200
123	Karlahalli	28-12-2018	265	20	250-350	1400
124	Halehalli	26-12-2018	270	22	250-350	800
125	Byranayakanahalli	02-01-2019	270	24	250-350	1200
126	Kelagere	02-01-2019	275	23	250-350	1200
127	Abbur	02-01-2018	270	25	250-350	1000
128	Huluvady	26-12-2018	299	21	250-350	1200
129	Thenkana halli **(2 borewells)**	23-01-2019	290	24	250-350	800
130	Avverahalli	01-01-2019	285	23	250-350	900
131	Kuri doddi	01-01-2019	290	25	250-350	400
132	Thimmasandra	01-01-2019	285	22	250-350	800
133	Aralimaradadoddi	01-01-2019	280	23	250-350	800
134	Mogenahalli	23-01-2019	275	24	250-350	1200
135	Nagavara **(2 borewells)**	23-01-2019	290	23	250-350	1600
136	Makali	23-01-2019	290	25	250-350	1200
137	Belakere	21-01-2019	275	22	250-350	1400
138	Mudigere	21-01-2019	280	22	250-350	1200
139	Mudigere plantation	21-01-2019	270	21	250-350	1000
140	Puttappanadoddi	21-01-2019	265	25	250-350	1200
141	Seebanahalli	21-01-2019	300	23	250-350	600
142	Chakkere **(2 borewells)**	23-01-2019	290	25	250-350	1000
143	Byrapatna	18-01-2019	265	25	250-350	1200
144	Kotamaranahalli	18-01-2019	270	23	250-350	800
145	Kukkur	16-01-2019	275	21	250-350	1200
146	Malurpatna	16-01-2019	265	25	250-350	1400

147	Kudlur	16-01-2019	265	22	250-350	1000
148	Devarahalli **(2 borewells)**	16-01-2019	270	25	250-350	900
149	Sankalagere	16-01-2019	270	23	250-350	1200
150	Channakegowdana doddi	16-01-2019	280	22	250-350	800
151	Govindegowdanadoddi	16-01-2019	285	21	250-350	900
152	Kodipura	28-12-2018	270	20	250-350	900
153	Mallamgere **(2 borewells)**	07-01-2019	290	25	250-350	1000
154	Moledoddi	27-12-2018	290	24	250-350	1000
155	Neelakantanahalli	27-12-2018	270	24	250-350	800
156	Lambani thandya	27-12-2018	290	24	250-350	800
157	Gollahalli doddi	27-12-2018	280	23	250-350	1200
158	Kannamangala	28-01-2019	275	23	250-350	1000
159	Brahmanipura	25-01-2019	290	23	250-350	1000
160	Chikkavitalenahalli	25-01-2019	285	22	250-350	1200
161	Yalachipalya	27-12-2018	290	23	250-350	1000
162	Silk form quarters	24-01-2019	270	24	250-350	600
163	Kencha bovi doddi	07-01-2019	280	24	250-350	800
164	Karikallu doddi	23-01-2019	280	23	250-350	1200
165	Hanumanthapur	04-06-2020	290	28	250-350	1300
166	Bhoohall	08-06-2020	270	20	250-350	2000
167	Doddanahalli	02-06-2020	312	6	250-350	600
168	Yalachipalya	02-06-2020	298	25	250-350	1200
169	Appagere	03-06-2020	272	20	250-350	2200
170	Channankegowdanaddoddi	01-06-2020	295	25	250-350	1000
171	Ramegowdanado	29-05-2020	262	25	250-350	1600
172	Nayidolle	05-06-2020	189	25	250-350	1800
173	Vaddaradoddi	12-06-2019	290	24	250-350	600
174	N.r colony	13-06-2019	290	24	250-350	800
175	Masigowdanadoddi	06-06-2019	285	24	250-350	700
176	Nelamakanahalli	11-12-2019	285	24	250-350	800
177	Sogala	06-12-2019	270	24	250-350	1400
178	Neraluru	07-12-2019	270	23	250-350	800
179	V G Doddi	09-12-2019	265	24	250-350	1400

Annexure-II: Tentative Locations of Proposed Percolation tanks, Channapatna Taluk, Ramanagara District.

S. No	Longitude	Latitude	Village	Grama Panchayat	Taluk
1	77.227579	12.570519	Mangadahalli	Virupakshipura	Channapatna
2	77.136893	12.616908	Govindanahalli	Chakkere	Channapatna
3	77.240978	12.665164	Chikkamannugudde Forest	Vandaraguppe	Channapatna
4	77.111982	12.717629	Bevuru	Bevooru	Channapatna
5	77.171457	12.780882	Makali State Forest	Makali	Channapatna

(Source: Master Plan, CGWB, 2020. It is likely that the number of structures proposed may vary depending upon the ground truth verification and feasibility criteria)