

CHIKMAGALUR DISTRICT



FIG.9 CHIKMAGALUR DISTRICT

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1. Location

Chikmagalur district is located in the southern part of Karnataka State with a geographical area of 7201 sq. km. It is bounded by Davanagere district on the northern side, Shimoga district on the northwestern and northern side, Udupi district on the western side, Dakshina Kannada district on the southwestern side, Hassan district on the southeastern side and Chitradurga district on the northeastern side. It lies between 12° 54' to 13° 54' N Latitude 75° 04' and 76° 22' E Longitude.

2. Demography

As per the 1991 census, Chikmagalur district has a population of 1,017,283. The total number of villages / habitations in the district are 2,345. Chikmagalur district has seven taluks viz. Chikmagalur, Kadur, Koppa, Mudigere, Narasimharajapura, Sringeri and Tarikere. Chikmagalur is the District Headquarters.

3. Climate, Drainage and Soil

The climate of the Chikmagalur district, a greater part of which has a hilly terrain, is on the whole, agreeable and cool. Extreme western parts of Chikmagalur district form part of the Western Ghats and Malnad region, which include the mountainous and Forested areas lying on the western edge of the ghats. Remaining portion of the district falls under southern maidan region consisting of broad undulating plateau with elevations ranging from 600 to 1000 m. The average annual rainfall in the district is 1989.8 mm. Chikmagalur district is drained by Bhadra, Vedavati and Tunga rivers and has a major reservoir built across Bhadra river near Narasimharajapura. Chikmagalur district experiences temperature variation between 17.5 ° to 30.9 ° C. Red and black soils cover the district. This district is grouped under the southern transition zone, central dry zone and hilly zone of the ten fold Agro-climatic classification of Karnataka.

4. Geology and Groundwater occurrence

Geologically, Chikmagalur district consists of wide spread gneissic terrain with isolated patches of gray granite. From the groundwater point of view, these rocks are classified as crystalline formations. The fracture / fissure system developed along with joints and faults traversing the rocks facilitate groundwater circulation and hold moderate quantity of water. The schist belt sequence consisting of conglomerate, quartzite, metavolcanics, pelitic schist and bands of iron formation are exposed in the eastern part of the district. These schistose / metamorphic rocks are relatively impermeable, poor aquifers and yield very less quantity of water of poorer quality. Groundwater generally occurs in the water table conditions in the weathered and decomposed mantle and also under semi-confined conditions in the deeper fractures.

5. Groundwater quality characterization

To understand and gather information on groundwater quality, 7685 samples collected from 1955 villages/habitations in Chikmagalur district have been analysed by RDED.

The water samples have been analysed for only 14 parameters such as Turbidity, Colour, Conductivity, Hydrogen ion concentration (pH), Total Dissolved Salts (TDS), Total Hardness (TH), Calcium Hardness (CaH), Chloride (Cl), Sulphate (SO₄), Fluoride (F), Nitrate (NO₃), Alkalinity (Alk), Iron (Fe) and Bacteria. The data is presented in the Table.

5.1 Physical Characters

Turbidity

About 2974 samples covering 1340 villages show higher turbidity ranging between 10.1 to 954 JTU. The samples showing higher turbidity are from Chikmagalur (624 out of 1643 samples), Kadur (153 out of 1834 samples), Koppa (260 out of 720 samples), Mudigere (744 out of 917 samples), Narasimharajapura (671 out of 868 samples), Sringeri (116 out of 344 samples) and Tarikere (406 out of 1359 samples). The highest turbidity of 954 JTU is recorded from Mavinakere village of Mudigere taluk. Turbidity values in the abnormal samples of Sringeri taluk cannot be given since in the analytical data the numerical values are not mentioned.

Colour

In total, 1172 samples covering 529 villages have shown higher colour intensity in the range of 26 to 1032 HU. The abnormal samples are from Chikmagalur (816 samples from 296 villages with colour intensity in the range of 26 to 1032 HU), Mudigere (187 samples out of 122 villages with colour intensity in the range of 26 to 450 HU) and Narasimharajapura (169 samples from 111 villages with colour intensity in the range of 26 to 318 HU) taluks. No abnormal Colour intensity is reported from Koppa and Sringeri taluks. Colour parameter has not been reported from Kadur and Tarikere taluks.

Electrical Conductivity (EC)

The range of EC value in the different taluks of Chikmagalur district are, Chikmagalur 10 to 7410 m mhos/cm, Kadur 200 to 9200 m mhos/cm, Koppa 8 to 778 m mhos/cm, Mudigere 10 to 109000 m mhos/cm, Narsimharajapura 30 to 270000 m mhos/cm, Sringeri 23 to 435 m mhos/cm and Tarikere 50 to 7600 m mhos/cm.

Hydrogen ion concentration (pH)

Totally 795 samples covering 336 villages have shown the pH value in the range of 5.1 to 9.45. The range of pH values recorded in the taluks are: Mudigere

(323 samples from 142 villages with pH value of 5.1 to 8.8), Narasimharajapura (246 samples from 94 villages with pH value of 5.19 to 6.49), Chikmagalur (214 samples from 90 villages with pH value of 5.5 to 9.45), Kadur (6 samples from 4 villages with pH value of 8.6 to 8.8), Koppa (4 samples from 4 villages with pH value of 6.36 to 6.48), Sringeri (a lone samples with pH value of 8.86) and Tarikere (a lone sample with pH value of 6.4).

5.2 Chemical Characters

Total Dissolved Salts (TDS)

Excluding 12 samples from 9 villages of Chikmagalur taluk, all the other samples from Kadur, Koppa, Mudigere, Narasimharajapura, Sringeri and Tarikere taluks have TDS content within the permissible limit. The abnormal samples from Chikmagalur taluk show TDS content in the range of 2100 to 3780 ppm.

Total Hardness (TH)

Only 295 samples spread across 130 villages have indicated higher TH content in the range of 602 to 3142 ppm. The range of TH values above the permissible limit in different taluks are: Chikmagalur (199 samples from 76 villages with TH content of 602 to 3142 ppm), Kadur (94 samples from 52 villages with TH content of 602.4 to 2349.6 ppm) and Tarikere (2 samples from 2 villages with TH content of 898 and 1640 ppm). The highest TH content of 3142 ppm is reported from Tadubenhalli village in Chikmagalur taluk.

Calcium Hardness (CaH)

There are 1631 samples spread across 399 villages having higher CaH ranging from 201.1 to 1958 ppm. The abnormal samples are from Kadur (1590 samples with CaH content of 201.1 to 1958 ppm), Mudigere (2 samples with CaH content of 207 and 260 ppm), Narasimharajapura (3 samples with CaH content of 209 to 253 ppm) and Tarikere (36 samples with CaH content of 202.9-1367 ppm) taluks. Highest CaH content of 1958 ppm is reported from Nagaralu (Gandhinagara) village in Kadur taluk. In Chikmagalur, Koppa and Sringeri taluks, CaH parameter has not been reported.

Chloride (Cl)

Only 22 samples analysed from 19 villages / habitations have shown higher Cl content in the range of 1010 to 1800 ppm. The abnormal Cl content noted in other taluks is- Chikmagalur (7 samples from 7 villages with Chloride content of 1014 to 1220 ppm), Kadur (13 samples from 10 villages with Chloride content of 1010 to 1800 ppm) and Tarikere (2 samples from 2 villages with Chloride content of 1150 and 1300 ppm). Highest Cl content of 1800 ppm is reported from Vakkalgere village in Kadur taluk. Samples analysed from Koppa, Mudigere, Narasimharajapura and Sringeri taluks have Chloride content within the permissible limit.

Sulphate (SO₄)

In the entire district, only 3 samples from Chikmagalur taluk have reported higher Sulphate content ranging between 441 and 721 ppm. No abnormal Sulphate concentration is reported from Kadur, Koppa, Mudigere, Narasimharajapura, Sringeri and Tarikere taluks.

Fluoride (F)

The analytical data has revealed Fluoride incidence in 60 samples collected from 54 villages / habitations. In these samples, Fluoride content is in the range of 1.51 to 6.9 ppm. The concentrational variation of fluoride reported in different taluks are: Chikmagalur (3 samples from 3 villages with Fluoride content of 1.9 to 6.9 ppm), Kadur (16 samples from 15 villages with Fluoride content of 1.6 to 3.4 ppm), Koppa (8 samples from 8 villages with Fluoride content of 1.53 to 2.72 ppm), Mudigere (2 samples from 2 villages with Fluoride content of 1.51 and 1.83 ppm), Narasimharajapura (6 samples from 3 villages with Fluoride content of 1.57 to 4 ppm), Sringeri (3 samples from 3 villages with Fluoride content of 1.6 to 1.65 ppm) and Tarikere (22 samples from 20 villages with Fluoride content of 1.6 to 6.7 ppm). Highest concentration of Fluoride (6.9 ppm) is reported from Kotteganahalli village in Chikmagalur taluk.

Nitrate (NO₃)

Only 2 samples, one each from Chikmagalur (one sample with 128.8 ppm) and Koppa (one sample with 160 ppm) taluk have reported slightly higher Nitrate content. No abnormal Nitrate concentration is reported from Kadur, Mudigere, Narasimharajapura, Sringeri and Tarikere taluks.

Alkalinity (Alk)

About 1289 samples from 406 villages have reported higher Alkalinity content in the range of 610 to 7800 ppm. Abnormal samples are from: Chikmagalur (9 samples from 8 villages with Alkalinity content of 656 to 1420 ppm), Kadur (1157 samples from 328 villages with Alkalinity content of 610 to 7800 ppm) and Tarikere (123 samples from 70 villages with Alkalinity content of 620 to 1800 ppm) taluks. Koppa, Mudigere, Narasimharajapura and Sringeri taluks have Alkalinity content within the permissible limit.

Iron (Fe)

In total, 1136 samples from 574 villages / habitations have analysed excess iron content ranging between 1.01 to 22.64 ppm. The abnormal samples are from Tarikere (399 samples from 160 villages with Fe content of 1.2 to 5 ppm), Chikmagalur (335 samples from 174 villages with Fe content of 1.01 to 22.64 ppm), Kadur (238 samples from 117 villages with Fe content of 1.2 to 6.2 ppm), Mudigere (118 samples from 78 villages with Fe content of 1.01 to 7.24 ppm), Narasimharajapura (22 samples from 21 villages with Fe content of 1.05 to 4.3

ppm), Sringeri (17 samples from 17 villages with Fe content of 1.25 to 4.9 ppm) and Koppa (7 samples from 7 villages with Fe content of 1.07 to 2.44 ppm) taluks. Highest iron content of 22.64 ppm is recorded from Surrappannahalli village in Chikmagalur taluk.

Bacteria (*E.coli*)

Nearly 1685 samples covering 988 villages/habitations have shown the presence of bacteria. The range of bacterial count for the district cannot be given since the analytical data has not specified it in Chikmagalur, Kadur, Koppa, Sringeri and Tarikere taluks. The number of samples with bacterial incidence in the different taluks are: Chikmagalur (388 out of 1643 samples), Kadur (273 out of 1834 samples), Koppa (291 out of 720 samples), Mudigere (156 out of 917 samples), Narasimharajapura (263 out of 868 samples), Sringeri (65 out of 344 samples) and Tarikere (249 out of 1359 samples). The Bacterial count in Mudigere and Narasimharajapura taluks ranges between 1 to 107 no.s per 100 ml.

5.3 Spatial Variation

Bacteria (*E.coli*)

The map indicates that, bacteria is more commonly seen in the analysed water samples and is spread unevenly throughout the district. No specific zonation is evident.

Fluoride (F)

The isoconcentration map of fluoride for Chikmagalur district (Fig.9A) depicts that, excepting two isolated patches in the northern portion of the district covering Tarikere taluk and few small isolated patches in Sringeri, Mudigere, Koppa, Narasimharajapura and Chikmagalur taluks, entire district is having Fluoride content within the permissible range.

Total Dissolved Salts (TDS)

The isoconcentration map generated for TDS (Fig.9B) shows that, entire district is having TDS content well within the permissible limit.

Total Hardness (TH)

Total hardness isoconcentration map (Fig.9C) reveals that, while Sringeri, Koppa, Narasimharajapura, Mudigere, Tarikere and western half of the Chikmagalur taluks have TH content within the permissible limit, the eastern portion of the Chikmagalur taluk and three isolated patches in the Kadur taluk have higher TH content.

Iron (Fe)

The spatial variation map generated for Iron (Fig.9D) shows that, in Chikmagalur district, only Tarikere, Mudigere and Chikmagalur taluks have higher iron content along with two isolated patches in Sringeri taluk.

6. Conclusion

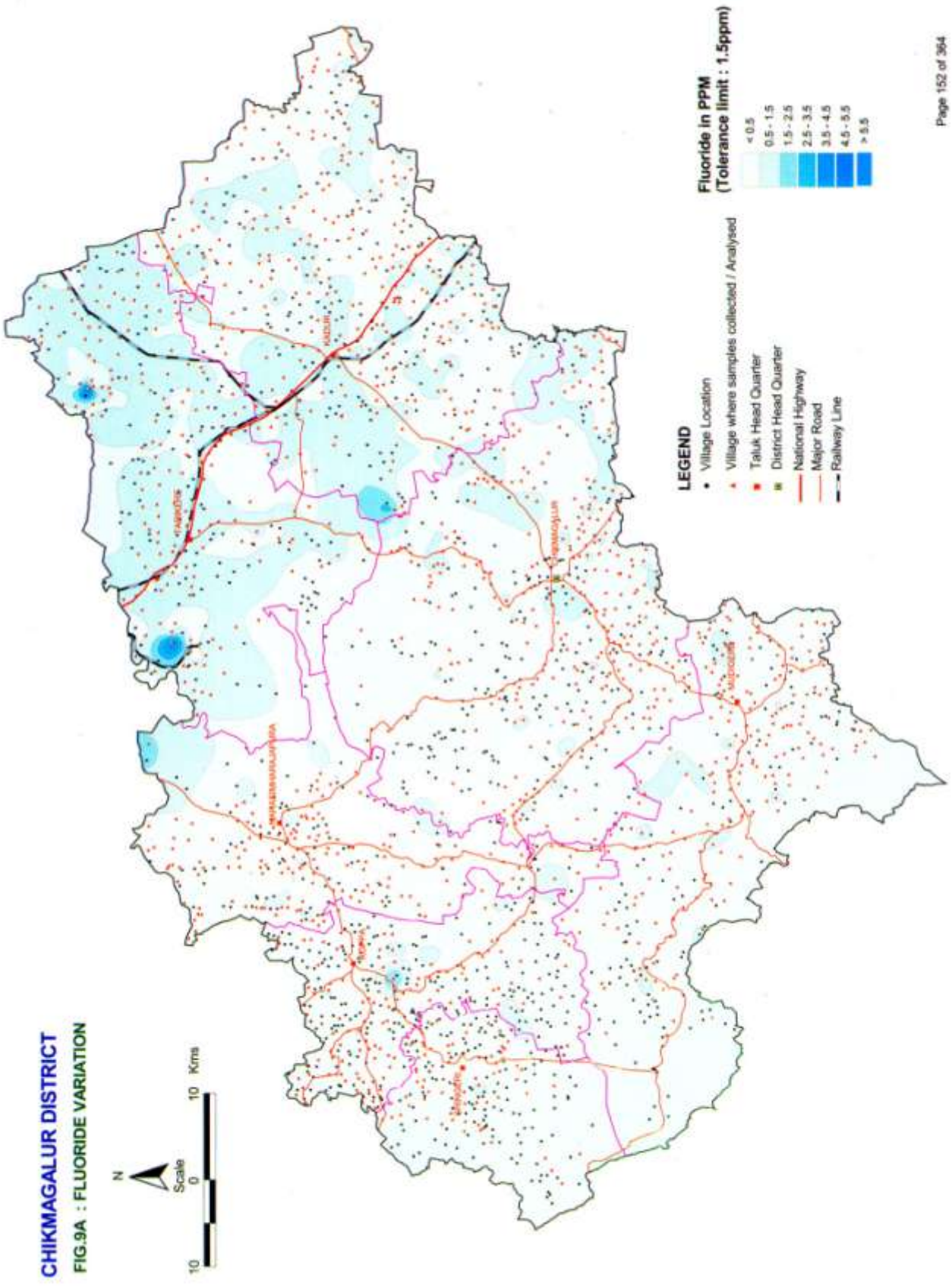
The water quality data of Chikmagalur district has reflected the presence of excess Turbidity, Colour, pH, higher concentrations of Calcium Hardness, Iron, and Alkalinity and Bacterial contamination. While the hardness can be reduced by some conventional methods, Turbidity and Colour can be reduced by simple filtration. The iron content can be reduced by proper development of the source and usage of galvanized iron / PVC pipes and proper casing. The most important component, which is much more harmful, is the presence of Bacteria viz., *E. coli* in the drinking water. The consumption of such water may cause the diseases such as Malaria, Diarrhea etc. These organisms might have been introduced into the groundwater regime by anthropogenic activities. This clearly indicates non-hygienic / poor sanitation condition prevailing at village levels. To overcome this, both the user and the administrator must be trained properly and awareness has to be created regarding hygienic aspects.

Table: Comprehensive analysis of water quality data of Chikmagalur District

SL. NO.	Name of the taluks	Number of villages/habitations	Number of samples analysed	Water quality scenario	Bact (c/100 ml)-0	Tur (10) JTU	Color (25) HU	Cond - mmhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	CaH (200) ppm	Cl (1000) ppm	SO ₄ (400) ppm	F (1.5) ppm	NO ₃ (100) ppm	Alk (600) ppm	Fe (1) ppm
1	Chikmagalur	530	366	No. of samples beyond permissible limit	388	624	816	-	214	12	199	-	7	3	3	1	9	335
				No. of villages affected	206	357	296	-	90	-	7	3	3	1	8	174		
				Range	Present	10.7-620	26-1032	10.7410	5.5-9.45	2100-3780	602-3142	-	10.14-1220	441-721	1.9-6.9	1.28.8	656-1420	1.01-22.64
2	Kadur	465	391	No. of samples beyond permissible limit	273	153	NA	-	6	-	94	1590	13	-	16	-	1157	238
				No. of villages affected	175	87	-	-	4	-	362	10	15	-	328	117		
				Range	Present	10.1-90.1	-	200-9200	8.6-8.8	602.4-2349.6	201.1-1958	10.10-1800	1.6-3.4	-	610-7800	1.2-6.2		
3	Koppa	330	220	No. of samples beyond permissible limit	291	260	-	-	4	-	-	NA	-	-	8	1	-	7
				No. of villages affected	137	145	-	-	4	-	-	-	8	1	-	7		
				Range	Present	28-145	-	8-778	6.36-6.48	-	-	-	1.53-2.72	160	-	1.07-2.44		
4	Mudgere	336	278	No. of samples beyond permissible limit	156	744	187	-	323	-	2	2	-	-	2	-	-	118
				No. of villages affected	111	251	122	-	142	-	2	-	2	-	-	78		
				Range	1-6	11-954	26-450	10-109000	5.1-8.8	207-260	-	1.51-1.83	-	1.01-7.24	-			
5	Narasimharajapura	293	262	No. of samples beyond permissible limit	263	671	169	-	246	-	-	3	-	-	6	-	-	22
				No. of villages affected	165	246	111	-	94	-	3	-	3	-	-	21		
				Range	1-107	11-510	28-318	30-270000	5.19-6.49	-	209-253	-	1.57-4	-	1.05-4.3			
6	Sringeri	209	191	No. of samples beyond permissible limit	65	116	-	-	1	-	-	NA	-	-	3	-	-	17
				No. of villages affected	53	94	-	-	1	-	-	-	3	-	-	17		
				Range	Present	T**	-	23-435	8.66	-	-	-	1.6-1.65	-	-	1.25-4.9		
7	Tankere	332	1359	No. of samples beyond permissible limit	249	406	-	-	1	-	2	36	2	-	22	-	123	399
				No. of villages affected	141	160	-	-	1	-	2	2	20	-	70	160		
				Range	Present	10.2-128.6	-	50-7600	6.4	888-1640	202.9-1367	1150-1300	1.6-6.7	-	620-1800	1.2-5		
Total	2495	1965	7685	No. of samples beyond permissible limit	1685	2974	1172	-	795	12	295	1631	22	3	60	2	1289	1136
				No. of villages affected	988	1340	529	-	336	9	130	399	19	3	54	2	406	574
				Range	Present	10.1-954	26-1032	8-270000	5.1-9.45	2100-3780	602-3142	201.1-1958	10.10-1800	441-721	1.51-6.9	1.28-160	610-7800	1.01-22.64

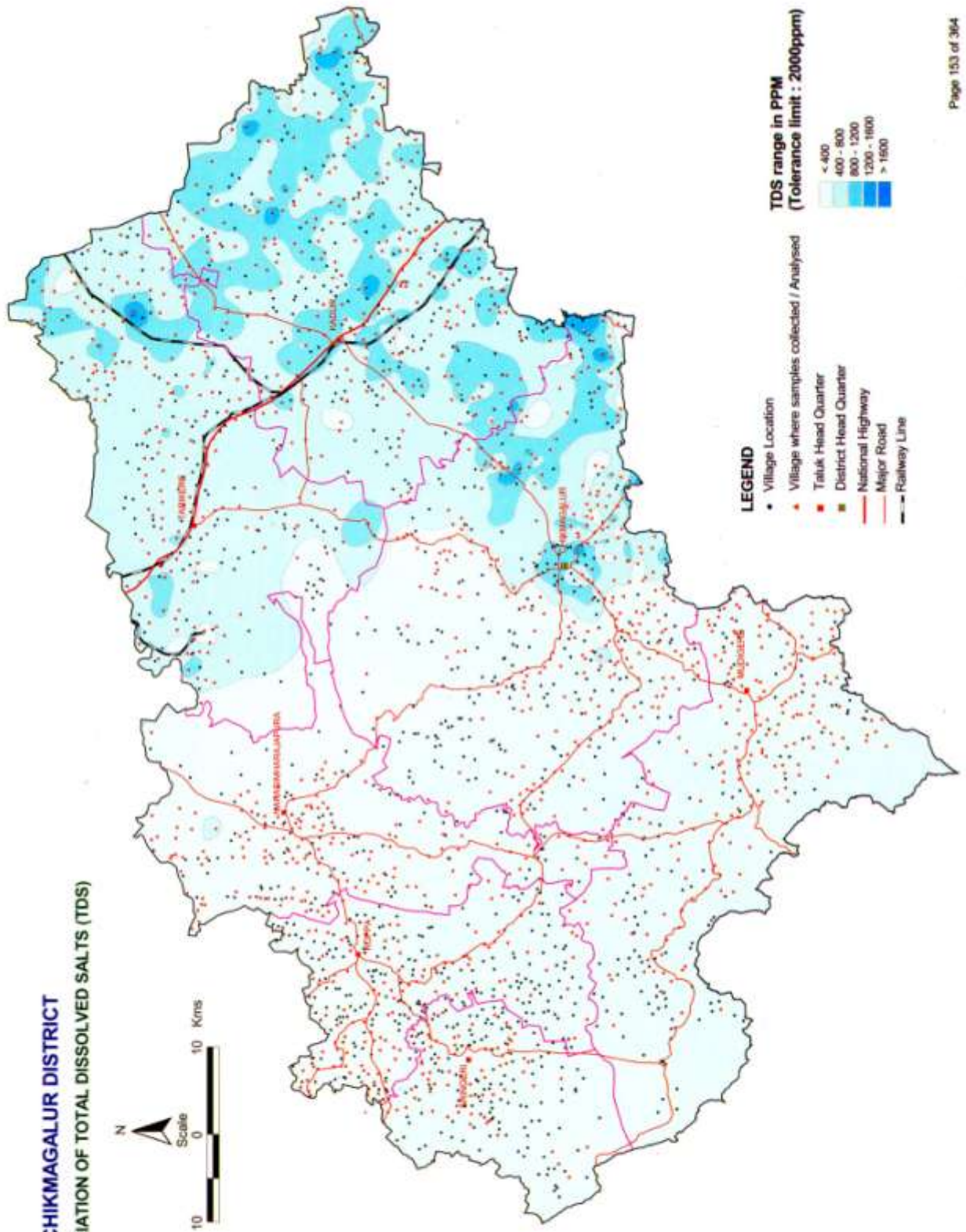
NOTE :- T** - Indicates highly Turbid and silt laden water.
NA - The Parameter has not been recorded.

CHIKMAGALUR DISTRICT
FIG.9A : FLUORIDE VARIATION



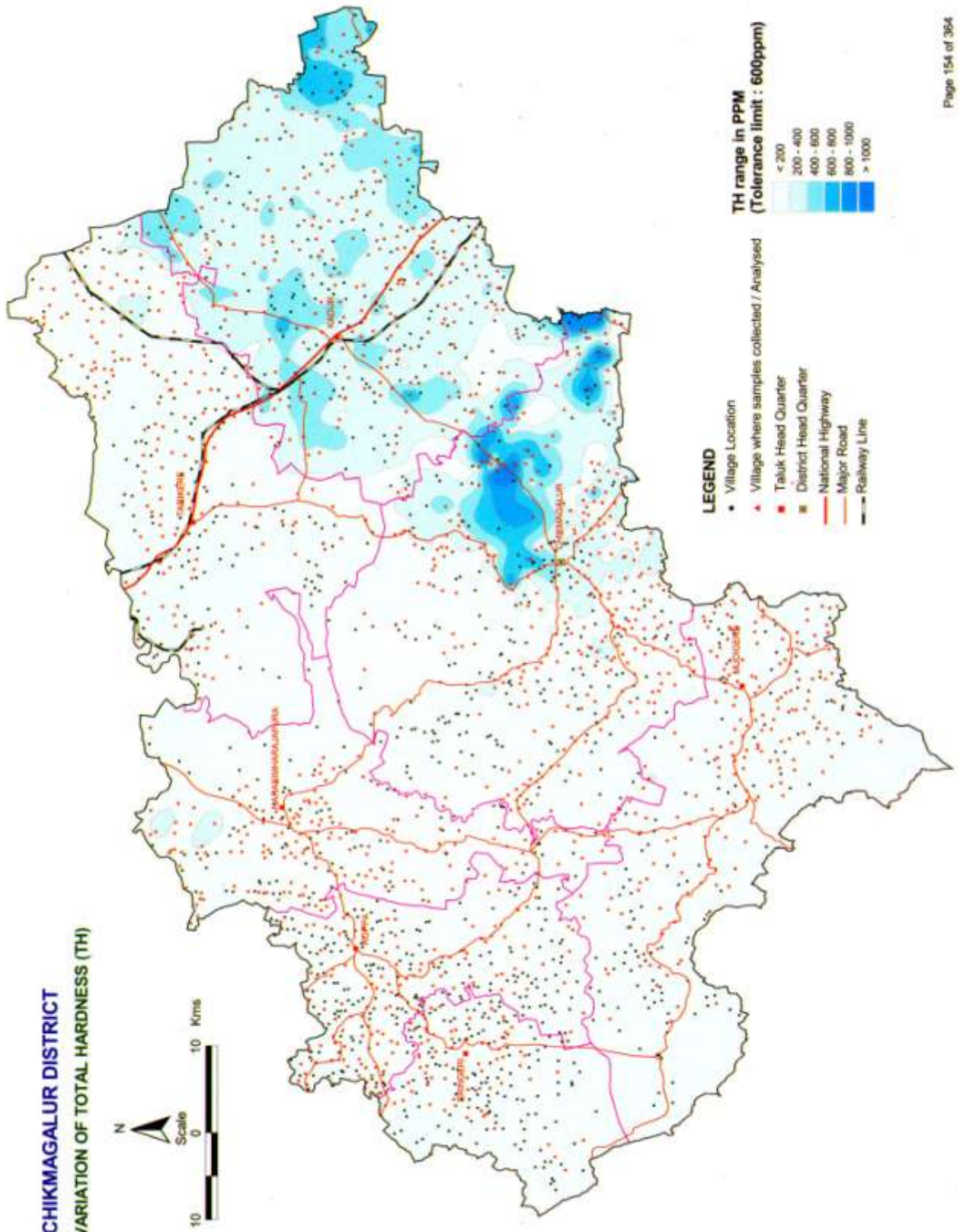
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FIG.9B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



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FIG.9C : VARIATION OF TOTAL HARDNESS (TH)



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FIG.9D : IRON VARIATION

