

## TUMKUR DISTRICT



**FIG.25 TUMKUR DISTRICT**

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## 1. Location

Tumkur district is located in the southeastern portion of Karnataka State and has the geographical area of 10,598 sq. km. It is bounded by Chitradurga district on northwestern side, Hassan district on western side, Mandya district on southern side, Bangalore (urban) district on southeastern side, Kolar district on eastern side and Andhra Pradesh State on northeastern side. It lies between 12° 45' to 14° 20' N Latitude and 76° 21' to 77° 31' E Longitude.

## 2. Demography

As per the 1991 census, Tumkur district has a population of 2,305,819. The total number of villages/habitations in the district is 5,484. Tumkur district has 10 taluks viz., Chikkanayakanahalli, Gubbi, Kortagere, Kunigal, Madhugiri, Pavagada, Sira, Tiptur, Tumkur and Turuvekere.

## 3. Climate, Drainage and Soil

Tumkur district experiences dry climate and it is grouped under southern maidan region. Shimsha and Jayamangali rivers drain the district. The Tumkur district experiences temperature variation between 20.4° C to 38.3° C. The average annual rainfall is 687.9 mm (Ref- Climate of Karnataka State, Published by India Meteorological Department, 1984). Major portion of the district is covered by red and sandy soils.

## 4. Geology and Groundwater occurrence

Geologically major part of the district is covered by Peninsular Gneisses (50 -60%) and remaining by the Closepet granite along with linear NS trending band of schistose formations. From the groundwater point of view the rocks are classified as crystalline formations. Groundwater occurs in the water table conditions in the weathered mantle and also under semi-confined conditions in the deeper fractures.

## 5. Groundwater quality characterization

To understand and gather information on groundwater quality, 11,752 groundwater samples collected from 3,777 villages/habitations in Tumkur 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<sup>-</sup>), Sulphate (SO<sub>4</sub><sup>-2</sup>), Fluoride (F), Nitrate (NO<sub>3</sub><sup>-</sup>), Alkalinity (Alk), Iron (Fe) and Bacteria and the data is presented in the Table.

## 5.1 Physical characters

### Turbidity

In the district, 1136 samples from 865 villages/ habitations have shown higher Turbidity ranging between 10.1 and 305 JTU. The samples showing higher Turbidity are from the taluks, Chikkanayakanahalli (126 out of 1038 samples), Gubbi (216 out of 1316 samples), Kortagere (84 out of 796 samples), Kunigal (147 out of 1560 samples), Madhugiri (63 out of 1148 samples), Pavagada (28 out of 956 samples), Sira (102 out of 1293 samples), Tiptur (57 out of 1060 samples), Tumkur (225 out of 1590 samples) and Turuvekere (88 out of 995 samples). Highest turbidity value of 305 JTU is recorded from Nandipura village in Gubbi taluk.

### Colour

In all, 403 samples from 352 villages/habitations have higher colour intensity ranging between 25-520 HU. The higher colour intensity in other taluks are Chikkanayakanahalli 30-59 HU (25 out of 1038 samples), Gubbi 30-50 HU (46 out of 1316 samples), Kortagere 30-60 HU (23 out of 796 samples), Kunigal 30-200 HU (87 out of 1560 samples), Madhugiri 30-380 HU (84 out of 1148 samples), Pavagada 30-520 HU (62 out of 958 samples), Sira 30-40 HU (4 out of 956 samples), Tiptur 25-100 HU (23 out of 1060 samples), Tumkur 30-72 HU (37 out of 1590 samples) and Turuvekere 30-70 HU (12 out of 995 samples). The highest colour intensity of 520 HU is from the village Srirangapura (M.M. tanda) in Pavagada taluk.

### Electrical Conductivity (EC)

The EC values recorded in the different taluks are: Chikkanayakanahalli 260-6000 m mhos/cm, Gubbi 100-5200 m mhos/cm, Kortagere 100-6300 m mhos/cm, Kunigal 200-7100 m mhos/cm, Madhugiri 319-10230 m mhos/cm, Pavagada 246-9384 m mhos/cm, Sira 200-9700 m mhos/cm, Tiptur 260-9500 m mhos/cm, Tumkur 0.13-7200 m mhos/cm and Turuvekere 270-7700 m mhos/cm.

### Hydrogen Ion Concentration (pH)

Only 183 samples covering 143 villages / habitations have recorded the variation in pH value from acidic to basic in the range of 1.84-9.4. The range of pH values recorded in other taluks are: Chikkanayakanahalli 8.51-9.4 (12 samples), Gubbi 1.9-8.9 (3 samples), Kortagere 6.3-9.4 (5 samples), Madhugiri 1.85-6.4 (8 samples), Pavagada 6.08-8.98 (15 samples), Sira 5.8-9.2 (73 samples), Tiptur 8.6-8.8 (23 samples), Tumkur 6.04-9.15 (40 samples) and Turuvekere 6.45-8.6 (4 samples). The samples analysed in Kunigal taluk have not recorded abnormal pH values.



## 5.2 Chemical Characters

### Total Dissolved Salts (TDS)

About 623 samples covering 375 villages / habitations have higher TDS content in the range of 2003-8090 ppm. The ranges of abnormal TDS content in different taluks are: Chikkanayakanahalli 2100-4300 ppm (63 samples), Gubbi 2100-2058 ppm (20 samples), Kortagere 2100-3500 ppm (6 samples), Kunigal 2010-4751 ppm (82 samples), Madhugiri 2010-5380 ppm (234 samples), Pavagada 2010-8090 ppm (78 samples), Sira 2100-5800 ppm (59 samples), Tiptur 2003-6365 ppm (66 samples), Tumkur 2100-4200 ppm (7 samples) and Turuvekere (2020-2460 ppm (8 samples). The highest value of 8090 ppm is reported from T.N.Patte village in Pavagada taluk.

### Total Hardness (TH)

In the district, 1983 samples spread across 1154 villages / habitations have indicated higher TH value ranging from 601 to 4462 ppm. The range of TH values recorded in different taluks are: Chikkanayakanahalli 601-3180 ppm (244 samples), Gubbi 605-2058 ppm (243 samples), Kortagere 601-2621 ppm (136 samples), Kunigal 604-2212 ppm (187 samples), Madhugiri 604-2616 ppm (291 samples), Pavagada 608-2116 ppm (124 samples), Sira 605-4462 ppm (307 samples), Tiptur 602-2844 ppm (189 samples), Tumkur 602-1695 ppm (146 samples) and Turuvekere 602-1688 ppm (116 samples). The highest TH content (4462 ppm) is reported from Marappanahalli village in Sira taluk.

### Calcium Hardness (CaH)

As many as 3072 samples spread across 1328 villages / habitations have indicated CaH value in the range from 201 to 1739 ppm. The range of higher CaH values in different taluks are: Chikkanayakanahalli 201-1051 ppm (105 samples), Gubbi 201-558 ppm (102 samples), Kortagere 201-891 ppm (63 samples), Kunigal 201-1041 ppm (388 samples), Madhugiri 201-1595 ppm (890 samples), Pavagada 202-1071 ppm (584 samples), Sira 201-959 ppm (91 samples), Tiptur 201-1735 ppm (722 samples), Tumkur 201-758 ppm (61 samples) and Turuvekere 201.6-599 ppm (66 samples). The maximum CaH content (1739 ppm) is reported from Belagarahalli village in Tiptur taluk.

### Chloride (Cl)

Excepting 72 samples covering 59 villages in the district, rest of all the samples have less than 1000 ppm Chloride content. Chloride value beyond permissible limit ranges from 1001-9643 ppm. The ranges of higher Chloride values in different taluks are: Chikkanayakanahalli 1001-1597 ppm (21 samples), Gubbi 1015-1146 ppm (2 samples), Kortagere 1223.79 ppm (lone sample), Kunigal 1024-1690 ppm (3 samples), Madhugiri 1001-1560 ppm (10 samples), Pavagada 1056-2128 ppm (8 samples), Sira 1002-9643 ppm (12 samples), Tiptur 1080-2060 ppm (7 samples), Tumkur 1043-2382 ppm (5 samples) and Turuvekere 1163-1107 ppm

(3 samples). The maximum Chloride content (9643 ppm) is reported from Kallambella village in Sira taluk.

### **Sulphate (SO<sub>4</sub>)**

In the entire district, 28 samples covering 27 villages / habitations have SO<sub>4</sub> content more than the permissible limit of 400 ppm. The variations in Sulphate content reported in different taluks are Chikkanayakanahalli 460-1100 ppm (3 samples), Gubbi 516 ppm (the lone sample), Kunigal 427-4200 ppm (5 samples), Madhugiri 612 ppm (the lone sample), Pavagada 448-1596 ppm (3 samples), Tiptur 415-947.5 ppm (12 samples) and Tumkur 450-2116 ppm (3 samples). The samples analysed in Kortagere, Sira and Turuvekere taluks have not reported abnormal concentration of SO<sub>4</sub>.

### **Fluoride (F)**

The analytical data has revealed the higher fluoride content in 1564 samples from 633 villages / habitations. These samples have shown abnormal Fluoride content in the range of 1.502-33.2 ppm. The fluoride concentration variation reported in different taluks is: Chikkanayakanahalli 1.53-9 ppm (71 samples), Gubbi 1.506-5.1 ppm (94 samples), Kortagere 1.51-7.3 ppm (128 samples), Kunigal 1.6-2 (2 samples), Madhugiri 1.55-3.5 ppm (397 samples), Pavagada 1.56-5.2 ppm (625 samples), Sira 1.502-1.99 ppm (59 samples), Tiptur 1.7-8 ppm (9 samples), Tumkur 1.501-33.2 ppm (145 samples) and Turuvekere 1.51-9.5 ppm (34 samples). Highest concentration of Fluoride (33.2 ppm) is reported from Kalenahalli village of Tumkur taluk

### **Nitrate (NO<sub>3</sub>)**

In the district, there are 2577 samples covering 1312 villages / habitations analysing NO<sub>3</sub> content in the range of 101 to 866 ppm. The abnormal samples are from the taluks: Chikkanayakanahalli 101-400 ppm (171 samples), Gubbi 101-766 ppm (288 samples), Kortagere 101-495 ppm (251 samples), Kunigal 101-793 ppm (1068 samples), Madhugiri 108-408 ppm (5 samples), Pavagada 101-149 ppm (38 samples), Sira 102-866 (183 samples), Tiptur 101-530 ppm (230 samples), Tumkur 101-600 ppm (170 samples) and Turuvekere 101-327 ppm (173 samples). Highest Nitrate content of 866 ppm is reported from the village Balapura in Sira taluk.

### **Alkalinity (Alk)**

About 430 samples from 317 villages have analysed excess Alkalinity in the range of 602 to 12065 ppm. The range of higher Alkalinity values in different taluks are: Chikkanayakanahalli 602-815 ppm (61 samples), Gubbi 607-794 ppm (15 samples), Kortagere 603.2-795 ppm (28 samples), Kunigal 602-1880 ppm (118 samples), Madhugiri 608-12065 ppm (24 samples), Pavagada 616-736 ppm (6 samples), Sira 602-1140 ppm (141 samples), Tiptur 604-890 ppm (29 samples) and Turuvekere 604-1940 ppm (8 samples). The maximum Alkalinity (12065-ppm)



is reported from Belladamadu village in Madhugiri taluk. The samples analysed from Tumkur taluk have not reported abnormal Alkalinity content.

### **Iron (Fe)**

Quite a good number of samples, 3690 samples from 2015 villages/ habitations in the district have analysed excess iron in the harmful range of 1.01-101 ppm. The variation of higher concentration in different taluks are: Chikkanayakanahalli 1.1-101 ppm (667 samples), Gubbi 1.1-56.2 ppm (758 samples), Kortagere 1.1-52.7 ppm (348 samples), Kunigal 1.1-38.30 ppm (265 samples), Madhugiri 1.01-9.36 ppm (213 samples), Pavagada 1.01-12.36 ppm (178 samples), Sira 1.1-27.9 ppm (413 samples), Tiptur 1.01-33.96 ppm (106 samples), Tumkur 1.02-56.2 ppm (491 samples) and Turuvekere 1.1-24.8 ppm (251 samples). The highest Fe value of 101 ppm is recorded from Karehalli village from the Chikkanayakanahalli taluk.

The samples analysed from all the taluks have shown concentration of iron much higher than the permissible limit. The possible reasons for the high concentrations are:

- There may be an error in the estimation of iron concentration in the analysis.
- It can be a recording error.
- Higher concentration can be due to rusting of the iron piping due to improper maintenance.
- Leaching of iron due to weathering and chemical disintegration.

### **Bacteria (*E.coli*)**

There are 1976 samples covering 1155 villages, which have shown the presence of Bacteria in the analysed samples. The bacterial count generally varies between 1 to 300 No.s /100 ml of water. The bacterial counts reported in different taluks are: Chikkanayakanahalli 5-50 (337 samples), Gubbi 2-300 (262 samples), Kortagere 3-50 (348 samples), Kunigal 1-154 (78 samples), Madhugiri 1-40 (85 samples), Pavagada 2-41 (86 samples), Sira 3-40 (101 samples), Tiptur 1-139 (140 samples), Tumkur 3-70 (284 samples) and Turuvekere 1-70 (255 samples).

## **5.3 Spatial Variation**

### **Bacteria (*E.coli*)**

The map depicting bacterial incidence indicates that, bacteria is more commonly reported in the district. Bacterial contamination is point specific and varies considerably.

### **Fluoride (F)**

The isoconcentration map (Fig. 25A) indicates that, small isolated patches of greater than 1.5 ppm concentration of Fluoride are seen in the southern half (along the western, southern and southeastern margins) of the district, while they are seen as large continuous patches in the northern half.

### **Total Dissolved Salts (TDS)**

The isoconcentration map generated (Fig. 25B) depicts that, except the small stretched patches mainly along the western margin, southern most portions and in the northern portion of the district, TDS level in the analysed samples is well below the permitted concentration.

### **Total Hardness (TH)**

Isoconcentration map of TH (Fig. 25C) presents a view where in higher concentration of TH are seen as small isolated patches of varying sizes spread throughout the district randomly. Chikkanayakanahalli taluk on the western border has comparatively higher TH concentration.

### **Iron (Fe)**

Isoconcentration map of Iron (Fig. 25D) reveals that, major portion of the district has iron content in the range of 1-5 ppm. Still higher concentrations going up to more than 40 ppm are also seen as clustered contours. The northern half and southwestern part have iron content in the range of 1-5 ppm where as, the southern portion of the district has iron content in the range of 5-10 ppm.

## **6. Conclusion**

The water quality data of Tumkur district has reflected the presence of excess Turbidity, CaH, TH, Fluoride, Nitrate, Iron and Bacteria. Turbidity can be reduced by simple infiltration. In case of Fluoride, utmost care has to be taken. Though a little amount of Fluoride is essential for the bone development in the infants, excess consumption of Fluoride will induce physical disabilities and Dental Fluorosis. Therefore, it is very essential to treat the water to the desirable standard before it is supplied for the drinking purpose. Changing irrigation practice and lesser application of chemical fertilizers can reduce the Nitrate levels. To overcome the problem related to the excess Iron content, an attention is required during the source development such as use 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 drinking water. The consumption of such water may cause the diseases such as Malaria, Diarrhea etc. Probably, the organisms 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.



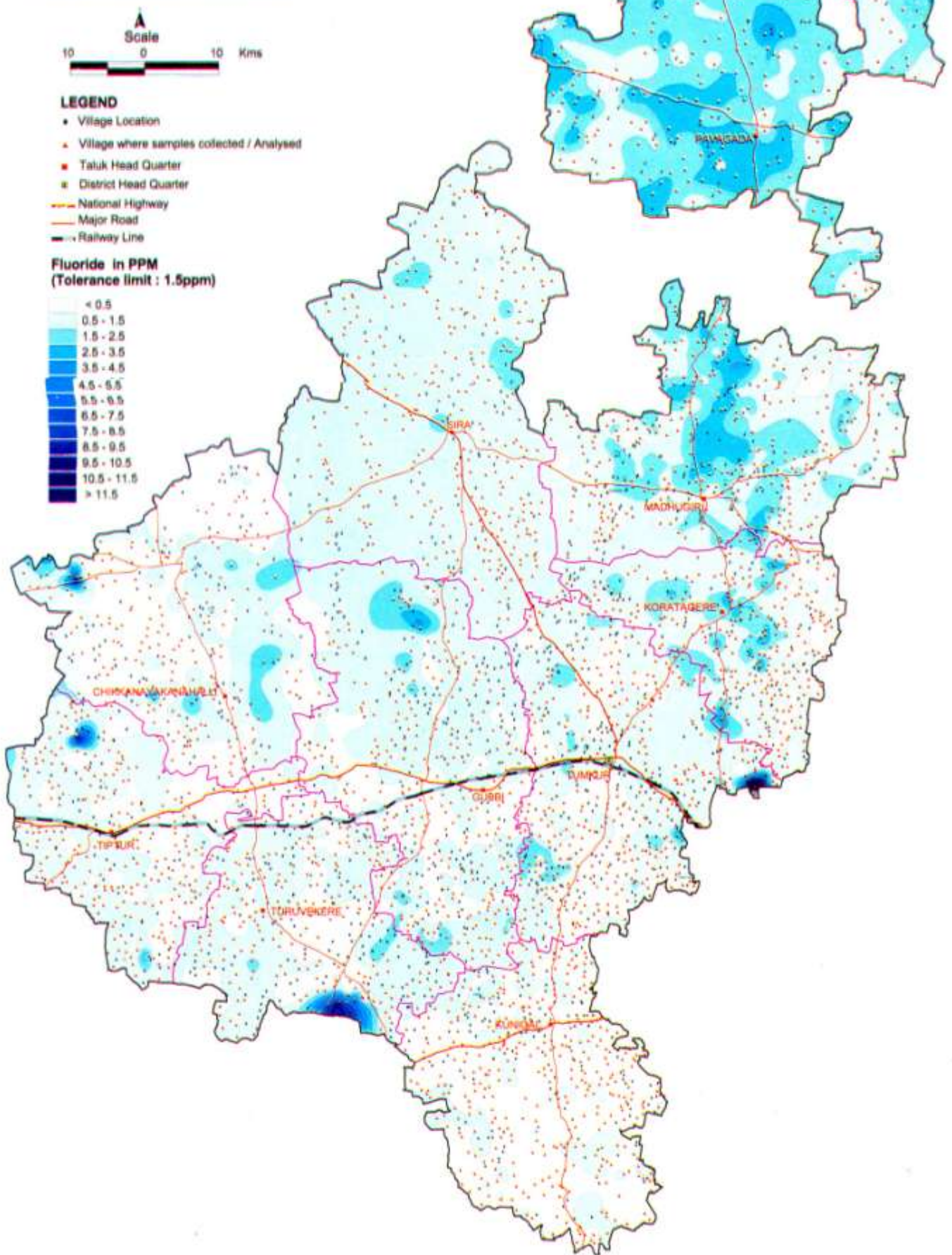
**Table: Comprehensive analysis of water quality data of Tumkur District**

SL. NO.	Name of the taluks	Number of villages/ habitations	Number of sampled villages	Number of samples analysed	Water quality scenario	Bact (G/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 <sub>4</sub> (400 ppm)	F (1.5 ppm)	NO <sub>3</sub> (100 ppm)	Alk (600 ppm)	Fe (1 ppm)
1	Chikkanyakanahalli	336	363	1038	No. of samples beyond permissible limit	337	126	25	-	12	63	244	105	21	3	71	171	61	667
					No. of villages affected	168	96	24	-	12	35	133	59	12	2	37	100	44	293
2	Gubbi	522	452	1316	Range	5-50	10.3-154	30-59	260-6000	8.5-9.4	2100-4300	601-3180	201-1051	1001-1597	460-1100	1.53-9	101-400	602-815	1.1-101
					No. of samples beyond permissible limit	262	216	46	-	3	20	243	2	1	94	288	15	758	
3	Kotagere	354	307	796	No. of villages affected	140	155	40	-	3	13	144	64	2	1	39	133	13	361
					Range	2-300	10.2-305	30-50	100-5200	1.9-8.9	2100-2058	605-2058	201-558	1015-1146	516	1506-5.1	101-766	607-794	1.1-56.2
4	Kunigal	516	560	1560	No. of samples beyond permissible limit	348	84	23	-	5	6	136	63	1	-	128	251	28	348
					No. of villages affected	185	72	23	-	4	4	87	42	1	-	70	148	24	233
5	Machhugri	425	355	1148	Range	3-50	10.2-181	30-60	100-6300	6.3-9.4	2100-3500	601-2621	201-891	1223-79	-	1.51-7.3	101-495	603.2-795	1.1-52.7
					No. of samples beyond permissible limit	78	147	87	-	82	187	388	3	5	2	1068	118	285	
6	Pavagada	231	211	956	No. of villages affected	70	119	79	-	55	131	251	3	3	5	1	443	89	180
					Range	1-154	10.10-195	30-200	200-7100	-	2010-4751	604-2212	201-1040	1024-1690	427-4200	1.6-2	101-793	602-1880	1.1-38.30
7	Sira	325	398	1293	No. of samples beyond permissible limit	85	63	84	-	8	234	291	890	10	1	397	5	24	213
					No. of villages affected	63	57	68	-	8	139	154	310	9	1	178	4	19	142
8	Tiptur	357	327	1060	Range	1-40	10.5-64	30-380	319-10230	1.85-6.4	2010-5380	604-2616	201-1595	1001-1560	612	1.55-3.5	108-408	608-12065	1.01-9.36
					No. of samples beyond permissible limit	86	28	62	-	15	78	124	584	8	3	625	38	6	178
9	Tumkur	609	501	1590	No. of villages affected	70	22	47	-	12	36	63	181	8	3	185	25	4	102
					Range	2-41	10.08-72	30-520	246-9384	6.08-8.96	2010-8090	608-2116	202-1071	1056-2128	448	1.56-5.2	101-149	616-736	1.01-12.36
10	Turuvekere	388	303	995	No. of samples beyond permissible limit	101	102	4	-	73	59	307	91	12	-	59	183	141	413
					No. of villages affected	64	78	4	-	58	37	171	55	10	29	115	94	242	
Total	4063	3777	11752	3777	Range	3-40	10.1-136	30-40	200-9700	5.8-9.2	2100-5800	605-4462	201-959	1002-9643	-	1.502-1.99	102-866	602-1140	1.1-27.9
					No. of samples beyond permissible limit	140	57	23	-	23	66	189	722	7	12	9	230	29	106
Total	4063	3777	11752	3777	No. of villages affected	111	43	21	-	13	45	118	278	7	12	7	138	23	73
					Range	1-139	10.1-51	25-100	260-9500	6.6-8.8	2003-6365	602-2844	201-1735	1080-2060	415-947.5	1.7-8	101-530	604-890	1.01-33.96
Total	4063	3777	11752	3777	No. of samples beyond permissible limit	284	225	37	-	40	7	146	61	5	3	145	170	-	491
					No. of villages affected	162	156	34	-	29	4	74	37	4	3	64	97	-	257
Total	4063	3777	11752	3777	Range	3-70	11-171	30-72	0.13-7200	6.04-9.15	2100-4200	602-1695	201-758	1043-2382	450-2116	1.501-33.2	101-600	-	1.02-56.2
					No. of samples beyond permissible limit	255	88	12	-	4	8	116	66	3	-	34	173	8	251
Total	4063	3777	11752	3777	No. of villages affected	122	67	12	-	4	7	79	51	3	-	23	109	7	132
					Range	1-70	10.9-133	30-70	270-7700	6.45-8.6	2020-2460	602-1688	201-6599	1163-1107	-	1.51-9.5	101-327	604-1940	1.1-24.6
Total	4063	3777	11752	3777	No. of samples beyond permissible limit	1976	1136	403	-	183	623	1983	3072	72	28	1564	2577	430	3690
					No. of villages affected	1155	865	352	-	143	375	1154	328	59	27	633	1312	317	2015
Total	4063	3777	11752	3777	Range	1-300	10.2-305	25-520	0.13-10230	1.9-9.4	2003-8090	602-4462	201-1735	1001-9643	415-4200	1.51-33.2	101-866	602-12065	1.01-101
					No. of samples beyond permissible limit	1300	102-305	25-520	0.13-10230	1.9-9.4	2003-8090	602-4462	201-1735	1001-9643	415-4200	1.51-33.2	101-866	602-12065	1.01-101



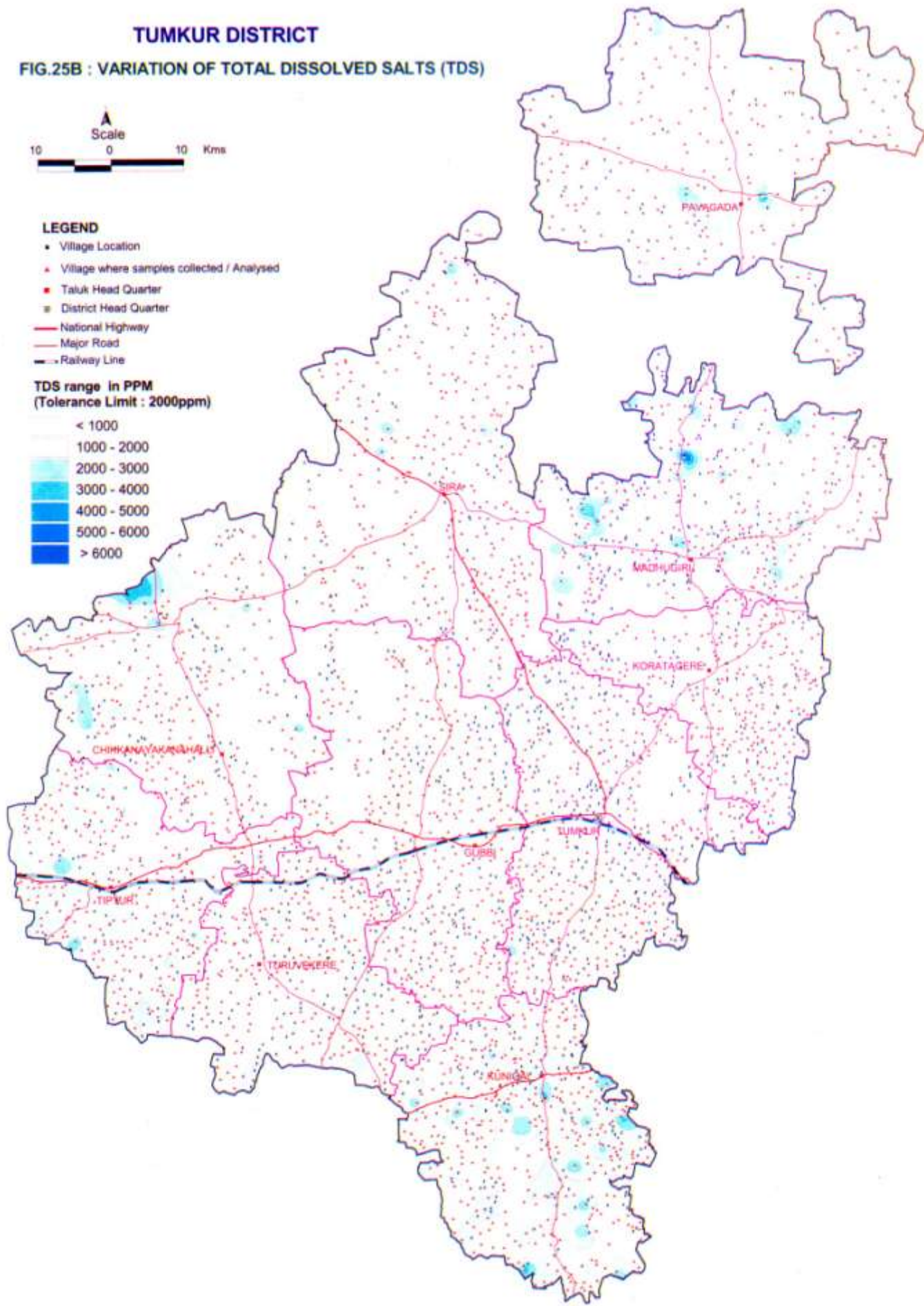
# TUMKUR DISTRICT

## FIG.25A : FLUORIDE VARIATION



# TUMKUR DISTRICT

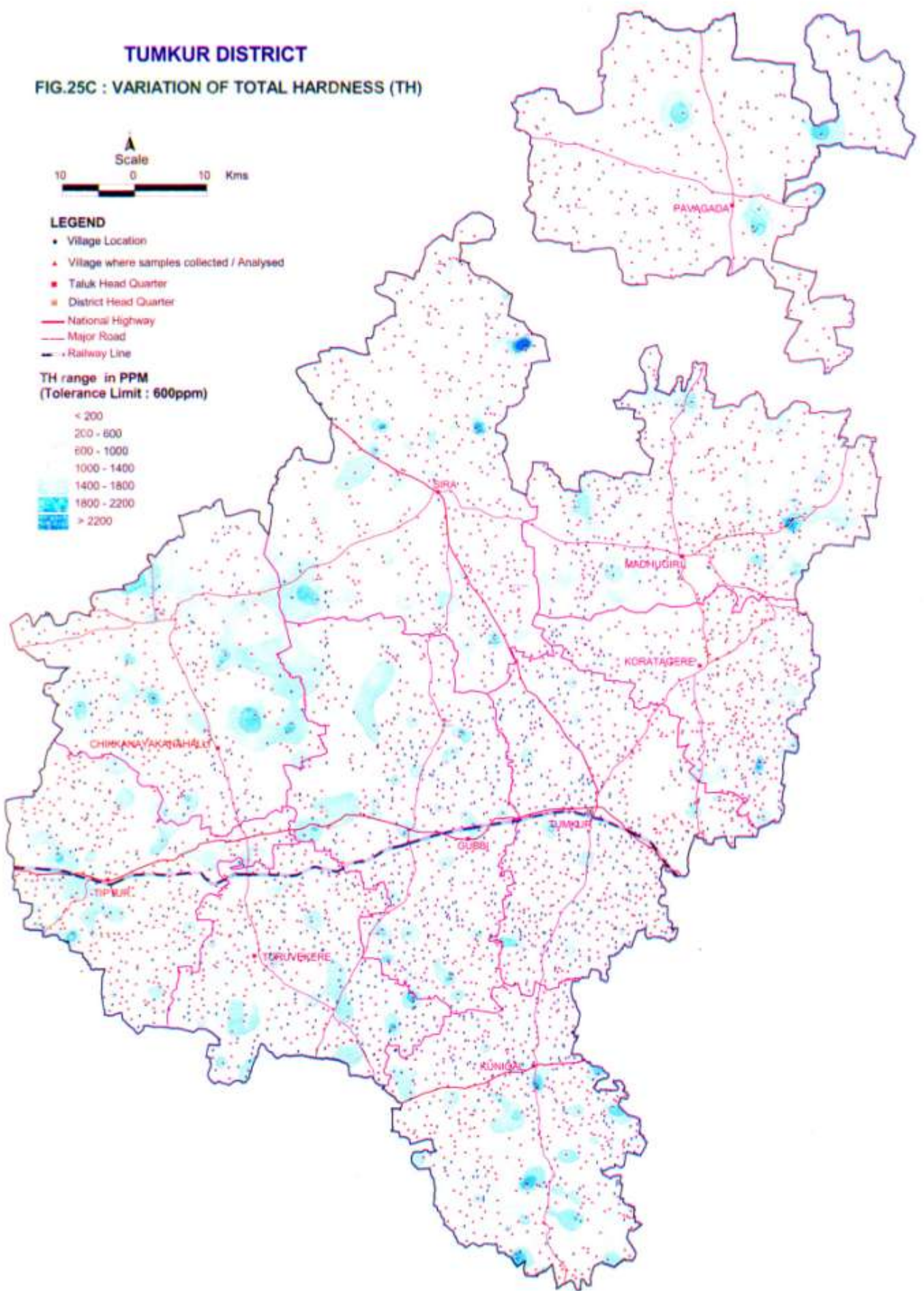
FIG.25B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)





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FIG.25C : VARIATION OF TOTAL HARDNESS (TH)





**TUMKUR DISTRICT**  
**FIG.25D : IRON VARIATION**



**LEGEND**

- Village Location
- ▲ Village where samples collected / Analysed
- Taluk Head Quarter
- District Head Quarter
- National Highway
- Major Road
- Railway Line

**Fe range in PPM**  
**(Tolerance Limit : 1ppm)**

