HASSAN DISTRICT

FIG.16 HASSAN DISTRICT

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1. Location

Hassan district is located in the southern part of Karnataka State and has geographical area of 6814 sq. km. It is bounded by Chikmagalur district on northwestern side, Dakhsina Kannada district on western side, Kodagu district on southwestern side, Mysore district on southern side, Mandya district on southeastern side and Tumkur district on northeastern side. It lies between 75^0 33' to 76^0 38' E Longitude and 12^0 31' to 13^0 33' N Latitude.

2. Demography

According to the 1991 census, Hassan district has a total population of 1,569,684. There are as many as 3900 habitations / villages. Hassan is the district Headquarter and is the only major city in the district. Hassan district has eight taluks viz. Alur, Arsikere, Arkalgud, Belur, Channarayapatna, Hassan, Holenarsipur and Sakleshpur.

3. Climate, Drainage and Soil

Hassan district forms part of the Western Ghats and Malnad region, which includes mountains and forested areas. Average annual rainfall in the district is 1040.7 mm (Ref: Climate of Karnataka State, Published by India Meteorological Department, 1984) and shows temperature ranging between 17.9 to 28.5° C. Hemavathi, Kaveri and Yagachi rivers drain Hassan district. This district is grouped under the southern transition zone, central zone and hilly zones of ten fold Agro-climatic classification of Karnataka. Major portion of the district is covered by red soil.

4. Geology and Groundwater occurrence

Geology of the Hassan district is quite simple. The Peninsular gneisses (PGC) cover almost 80% of aerial extent of the district. The younger granite occurs as isolated patches and domes. 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 quality of groundwater is governed by the mineralogical composition of the rocks. The volcano-sedimentary sequence consisting of conglomerate, orthoquartzite, quartz-chlorite schist, pelitic schists, iron formations and metavolcanics are also exposed. The schistose rocks are poor aquifers and yield very less quantity of water of poorer quality. The joint pattern controls movement of water in the metavolcanic rocks and normally yields better quality water. Groundwater in general 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, 10804 samples collected from 2,648 villages/habitations in Hassan 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 (CalH), Chloride (Cl), Sulphate (SO_4), Fluoride (F), Nitrate (NO_3), Alkalinity (Alk), Iron (Fe) and Bacteria. The data is presented in the Table.

5.1 Physical Characters

Turbidity

Only 101 samples covering 90 villages show higher turbidity ranging between 12 to 90 JTU. Turbidity affected samples in different taluks are; Alur (35 out of 912 samples), Arsikere (4 out of 3225 samples), Arkalgud (53 out of 1225 samples) and Sakleshpur (9 out of 805 samples). The water with highest turbidity of 90 JTU is recorded from Koukodi village of Sakleshpur taluk and Bychanahalli village of Arkalgud taluk. No abnormal turbidity values are reported from Belur, Channarayapatna, Hassan and Holenarsipur taluks.

Colour

Only 18 samples from 17 villages have reported the colour intensity more than the desired limit in the range of 26 to 90 HU. These abnormal samples are from Alur (2 samples from 2 villages with colour intensity of 40 HU) and Arkalgud (16 samples from 15 villages with colour intensity in the range of 26 to 90 HU). No abnormal colour intensity is reported from Arsikere, Belur, Channarayapatna, Hassan, Holenarsipur and Sakleshpur taluks.

Electrical Conductivity (EC)

The range of EC values noted in the taluks are; Alur 42-3085 m mhos/cm, Arkalgud 124-3540 m mhos/cm, Arsikere 97-7450 mmhos/cm, Belur 46-6540 mmhos/cm, Channarayapatna 148-8341 mmhos/cm, Hassan 27-4956 m mhos/cm, Holenarsipur 162-4956 mmhos/cm and Sakleshpur 30-1174 m mhos/cm.

Hydrogen ion concentration (pH)

Only 6 samples have reported abnormal pH content. 4 samples are from Arsikere taluk and they are basic in nature and one sample each in Belur and Sakleshpur taluks have reported acidic values. No abnormal pH values have been reported from Alur, Arkalgud, Channarayapatna, Hassan and Holenarsipur taluks.

5.2 Chemical Characters

Total Dissolved Salts (TDS)

In the district, 88 samples covering 64 villages / habitations have higher content of TDS in the range between 2001 and 15950 ppm. The ranges of abnormal TDS content in different taluks are; Arkalgud (3 samples with TDS content of 2014 to 2160 ppm), Arsikere (30 samples with TDS content of 2004 to 3720 ppm), Belur (2 samples with TDS content of 2068 to 3300 ppm), Channarayapatna (35 samples with TDS content of 2011 to 3538 ppm), Hassan (6 samples with TDS content of 2001 to 15950 ppm) and Holenarsipur (12 samples with TDS content of 2020 to 3912 ppm). Alur and Sakleshpur taluks have reported TDS content well within the permissible limit. The highest value of 15950 ppm is reported from Channapatna village of Hassan taluk.

Total Hardness (TH)

About 773 samples spread across 456 villages have indicated higher TH value in the range of 601 to 3000 ppm. The range of higher TH values in other taluks are; Alur (17 samples covering 13 villages with TH content of 608 to 995 ppm), Arkalgud (77 samples covering 54 villages with TH content of 602 to 1180 ppm), Arsikere (297 samples covering 148 villages with TH content of 603 to 2300 ppm), Belur (69 samples covering 44 villages with TH content of 609 to 1000 ppm), Channarayapatna (147 samples covering 85 villages with TH content of 602 to 1905 ppm), Hassan (89 samples covering 60 villages with TH content of 601 to 3000 ppm) and Holenarsipur (77 samples covering 52 villages with TH content of 605 to 1390 ppm). No abnormality of TH is reported from Sakleshpur taluk.

Calcium Hardness (CalH)

There are as many as 705 samples spreading across 340 villages having CalH above the limit ranging from 201-960 ppm. The maximum abnormal samples are from Channarayapatna (434 samples from 200 villages with CalH content of 202-800 ppm), Holenarsipur (249 samples from 122 villages with CalH content of 201-960 ppm), Arkalgud (18 samples from 15 villages with CalH content of 207-340 ppm) and Alur (4 samples from 3 villages with CalH content of 220-276 ppm). No abnormal CalH content is reported from Arsikere, Belur, Hassan and Sakleshpur taluks.

Chloride (Cl)

Only 8 samples have recorded higher Cl content ranging from 1055 to 6360 ppm. 4 samples from Arsikere, a lone sample from Belur and 3 samples from Hassan taluks have reported slightly higher Chloride content. None of the samples in Alur, Arkalgud, Channarayapatna, Holenarsipur and Sakleshpur taluks have reported Chloride content beyond the permissible limit.

Sulphate (SO_4)

In the entire district, only 25 samples covering 23 villages / habitations have (SO_4) content in the range of 417 to 2700 ppm. The higher sulphate content in the different taluks are; Arsikere (21 samples covering 20 villages with Sulphate content of 417 to 725 ppm), Belur (a lone sample with Sulphate content of 640 ppm), Channarayapatna (a lone sample with Sulphate content of 756 ppm) and Hassan (2 samples covering a village with Sulphate content of 2200 and 2700 ppm). The maximum (2700 ppm) is reported from Channapatna village of Hassan taluk.

Fluoride (F)

In all, 309 samples covering 161 villages have recorded higher Fluoride content in the range of 1.51 to 8.7 ppm. Of these abnormal samples, 266 samples (86%) are from Arsikere taluk, followed by 21 samples from Channarayapatna taluk, 11 samples from Hassan taluk and Alur, Arkalgud and Belur taluks have reported one abnormal sample in each taluk with Fluoride content of 1.6, 1.88 and 1.67 ppm respectively. Holenarasipur taluk has fluoride content ranging between 1.55-1.87 ppm (8 samples). Sakleshpur taluk has Fluoride content well within the permissible limit. Highest concentration of Fluoride (8.7 ppm) is reported from Channapatna village of Hassan taluk.

Nitrate (NO_3)

Just 24 samples covering 12 villages have shown high nitrate content ranging between 105-1740 ppm. The abnormal samples are from Arsikere (21 samples from 10 villages with Nitrate content of 105 to 462 ppm), Belur (a lone sample with Nitrate content of 108 ppm) and Hassan (2 samples from a village with Nitrate content of 1590 and 1740 ppm). Extreme Nitrate content of 1590 and 1740 ppm is reported from Channapatna village of Hassan taluk. Alur, Arkalgud, Channarayapatna and Sakleshpur taluks have not shown abnormal nitrate content.

Alkalinity (Alk)

About 315 samples have Alkalinity in excess in the range between 602 and 2700 ppm. The maximum Alkalinity values in different taluks are; Arsikere (180 samples with alkalinity content of 602-1600 ppm), Belur (40 samples with alkalinity content of 610-915 ppm), Hassan (35 samples with alkalinity content of 608 to 2700 ppm), Holenarsipur (29 samples with alkalinity content of 602-1790 ppm), Channarayapatna (21 samples with alkalinity content of 605 to 782 ppm) and Arkalgud (10 samples with alkalinity content of 615-740 ppm). Highest Alkalinity content of 2700 ppm is reported from Channapatna village of Hassan taluk. No abnormal Alkalinity values are reported from Alur and Sakleshpur taluks.

Iron (Fe)

In the entire district, 457 samples from 353 villages/habitations have analysed Iron content beyond the permissible limit ranging between 1.01 and 8.24 ppm. These samples are from Alur (99 samples covering 71 villages with Fe content of 1.01 to 7.29 ppm), Arkalgud (97 samples covering 82 villages with Fe content of 1.01 to 3.5 ppm), Arsikere (13 samples covering 12 villages with Fe content of 1.07 to 1.71 ppm), Belur (38 samples covering 34 villages with Fe content of 1.03 to 4.56 ppm), Channarayapatna (26 samples covering 22 villages with Fe content of 1.02 to 7.12 ppm), Hassan (19 samples covering 14 villages with Fe content of 1.02 to 2.57 ppm), Holenarsipur (75 samples covering 51 villages with Fe content of 1.01 to 8.24 ppm) and Sakleshpur (90 samples covering 67 villages with Fe content of 1.01 to 5.66 ppm). The highest Fe content of 8.24 ppm is recorded from Elechakanahali village of Holenarsipur taluk.

Bacteria (*E.coli*)

In all 577 samples covering 539 villages / habitations have shown the presence of hazardous organism *E.coli* in drinking water. The Bacterial count generally ranges between 1 and 12 numbers /100 ml. These affected samples are from Alur (26 samples), Arkalgud (132 samples), Arsikere (198 samples), Belur (8 samples), Channarayapatna (94 samples), Hassan (41 samples), Holenarsipur (34 samples) and Sakleshpur (44 samples). The bacterial count in Arsikere, Belur, Channarayapatna and Hassan taluks cannot be given since in the analytical data the numerical values are not mentioned.

5.3 Spatial Variation

Bacteria (*E.coli*)

A perusal of the bacterial incidence map indicates that, the bacterial incidence is a common phenomenon in the sampled villages.

Fluoride (F)

The isoconcentration map (Fig. 16A) reveals that, fluoride content is in safe limit range in the western half. In comparison, eastern half covering Arsikere, Channarayapatna, Hassan, Holenarsipur and parts of Arkalgud taluks have slightly higher Fluoride content and Arsikere taluk forming the northern portion has highest Fluoride concentration.

Total Dissolved Salts (TDS)

The isoconcentration map (Fig.16B) shows that, in general very small isolated patches of higher TDS concentrations are confined to Arsikere, Hassan, Channarayapatna and Holenarsipur taluk and the western half of the district has TDS well below the safe limit.

Total Hardness (TH)

Total hardness on the isoconcentration map (Fig.16C) indicates that, higher concentration of Total Hardness is confined to the central and northern part covering Hassan, Arsikere and parts of Belur and Channarayapatna taluks.

Iron (Fe)

Isoconcentration map (Fig.16D) has shown confinement of higher concentrations of Iron to isolated patches mostly in the central part of the district covering parts of Belur, Sakleshpur, Alur, Arkalgud and Hassan taluks and eastern portion covering Channarayapatna taluk.

6. Conclusion

The water quality data of Hassan district has reflected the presence of excess Total Hardness, Calcium Hardness, Iron, Fluoride and the Bacterial content. Hardness can be reduced by some conventional methods. 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. To overcome from the problem arising due to excess of Iron, 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. 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 Hassan District

SL. NO.	NAME OF THE TALUKS	Number of villages/ habitations	Number of sampled villages	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	CalH (200) ppm	Cl (1000) ppm	SO_4 (400) ppm	F (1.5) ppm	NO_3 (100) ppm	Alk (600) ppm	Fe (1) ppm
1	Alur	334	255	912	No. of samples beyond permissible limit	26	35	2	-	-	-	17	4		-	1	-	-	99
					No. of Village affected	25	30	2	-	-	-	13	3	-	-	1	-	-	71
					Range	1-8	20-80	40	42-3085	-	-	608-995	220-276	-	-	1.6	-	-	1.01-7.29
2	Arsikere	542	505	3225	No. of samples beyond permissible limit	198	4	-	-	4	30	297	-	4	21	266	21	180	13
					No. of Village affected	178	4	-	-	4	19	148	-	4	20	127	10	100	12
					Range	Possitive	12-60	-	97-7450	8.69-8.8	2004-3720	603-2300	-	1055-1350	417-725	1.51-3.7	105-462	602-1600	1.07-1.71
3	Arkalgud	389	300	1225	No. of samples beyond permissible limit	132	53	16	-	-	3	77	18	-	-	1	-	10	97
					No. of Village affected	127	47	15	-	-	3	54	15	-	-	1	-	10	82
					Range	4-12	15-90	26-90	124-3540		2014-2160	602-1180	207-340	-	-	1.88	-	615-740	1.01-3.5
4	Belur	459	374	1087	No. of samples beyond permissible limit	8	-	-	-	1	2	69	-	1	1	1	1	40	38
					No. of Village affected	8	-	-	-	1	2	44	-	1	1	1	1	29	34
					Range	Possitive	-	-	46-6540	6.11	2068-3300	609-1000	-	1081	640	1.67	108	610-915	1.03-4.56
5	Channarayapatna	476	397	1405	No. of samples beyond permissible limit	94	-	-	-	-	35	147	434	-	1	21	-	21	26
					No. of Village affected	87	-	-	-	-	23	85	200	-	1	15	-	16	22
					Range	2-6	-	-	148-8341	-	2011-3538	602-1905	202-800	-	756	1.54-2.1	-	605-782	1.02-7.12
6	Hassan	524	403	1244	No. of samples beyond permissible limit	41	-	-	-	-	6	89	-	3	2	11	2	35	19
					No. of Village affected	39	-	-	-	-	5	60	-	2	1	8	1	27	14
					Range	Possitive	-	-	27-4956	-	2001-15950	601-3000	-	1080-6360	2200-2700	1.56-8.7	1590-1740	608-2700	1.02-2.57
7	Holenarsipura	305	211	901	No. of samples beyond permissible limit	34	-	-	-	-	12	77	249	-	-	8	-	29	75
					No. of Village affected	34	-	-	-	-	12	52	122	-	-	8	-	22	51
					Range	2-6	-	-	162-4956	-	2020-3912	605-1390	201-960	-	-	1.55-1.87	-	602-1790	1.01-8.24
8	Sakleshpura	429	203	805	No. of samples beyond permissible limit	44	9	-	-	1	-	-	-	-	-	-	-	-	90
					No. of Village affected	41	9	-	-	1	-	-	-	-	-	-	-	-	67
					Range	2-8	12-36	-	30-1174	6.35	-	-	-	-	-	-	-	-	1.01-5.66
	Total	3458	2648	10804	No. of samples beyond permissible limit	577	101	18	-	6	88	773	705	8	25	309	24	315	457
					No. of villages affected	539	90	17	-	6	64	456	340	7	23	161	12	204	353
					Range	2-12	12-90	26-90	27-8341	6.11-8.8	2001-15950	601-3000	201-960	1055-6360	417-2700	1.51-8.7	105-1740	602-2700	1.01-8.24

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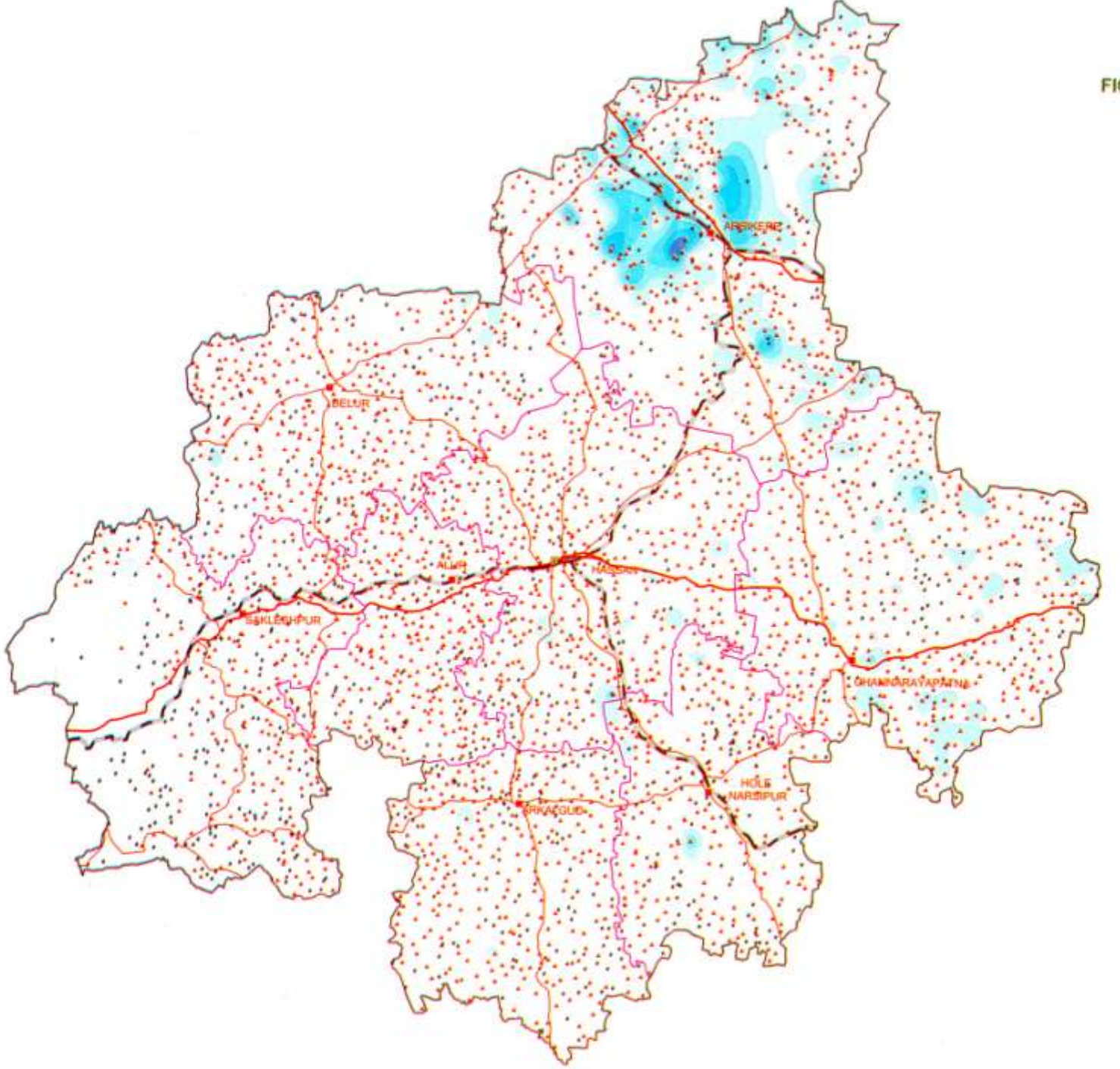
FIG.16A : FLUORIDE VARIATION



N

Scale

10 0 10 Kms

LEGEND

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

Fluoride in PPM
(Tolerance limit : 1.5ppm)

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- > 3.0

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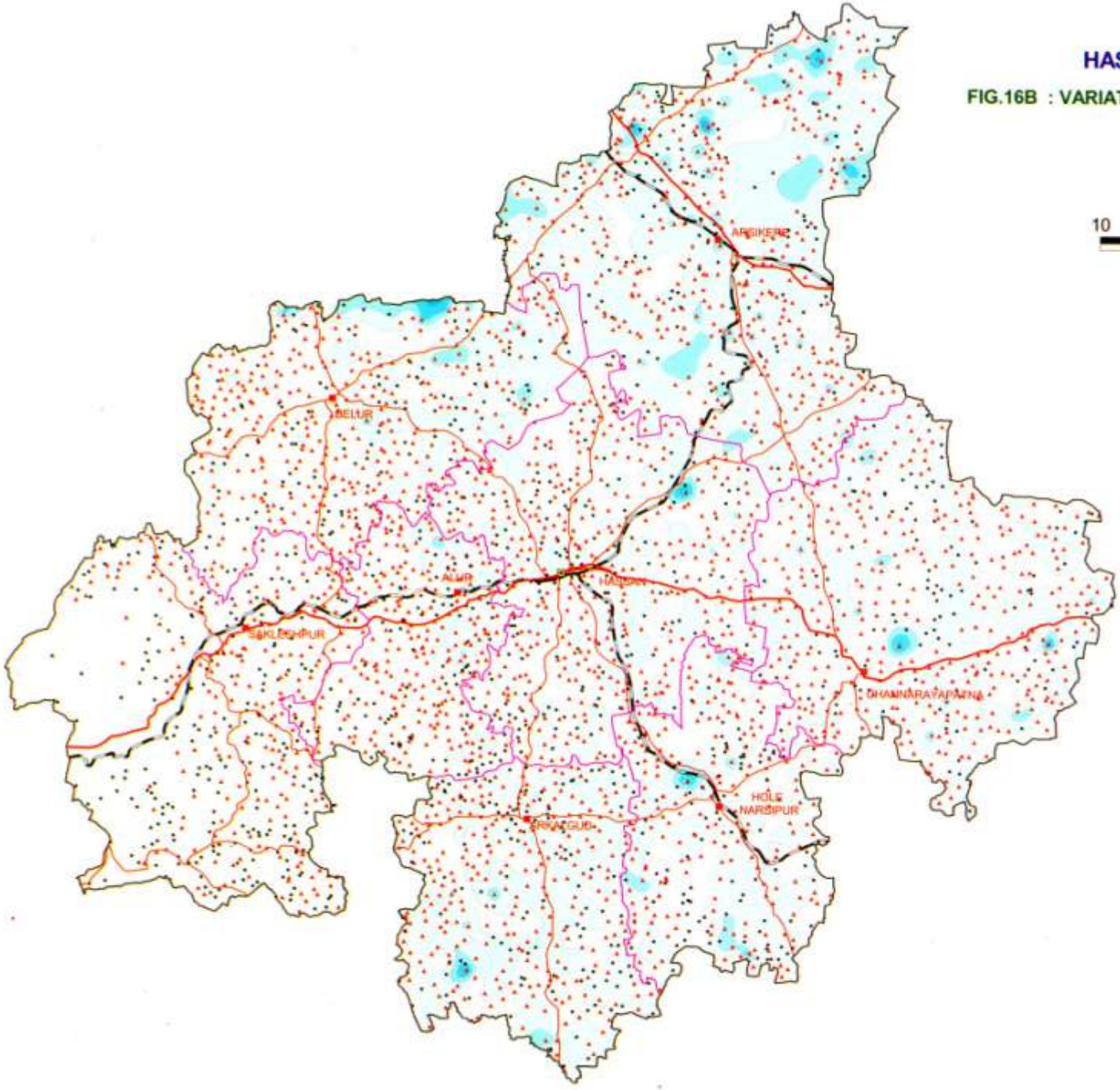
FIG.16B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



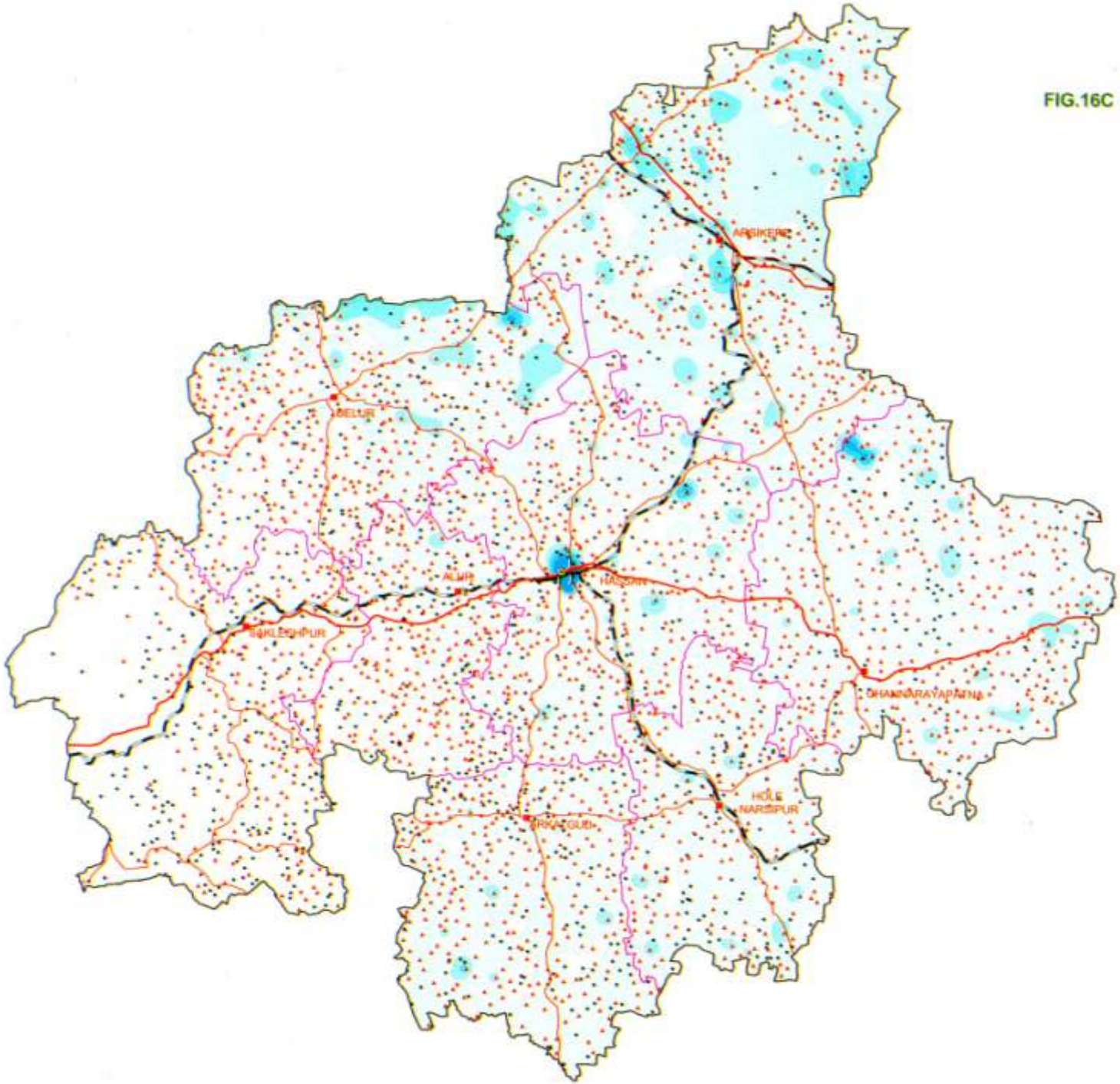


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FIG.16C : VARIATION OF TOTAL HARDNESS (TH)

N

Scale

10 0 10 Kms

LEGEND

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

TH range in PPM
(Tolerance limit : 600ppm)

- < 200
- 200 - 600
- 600 - 1000
- 1000 - 1400
- 1400 - 1800
- > 1800

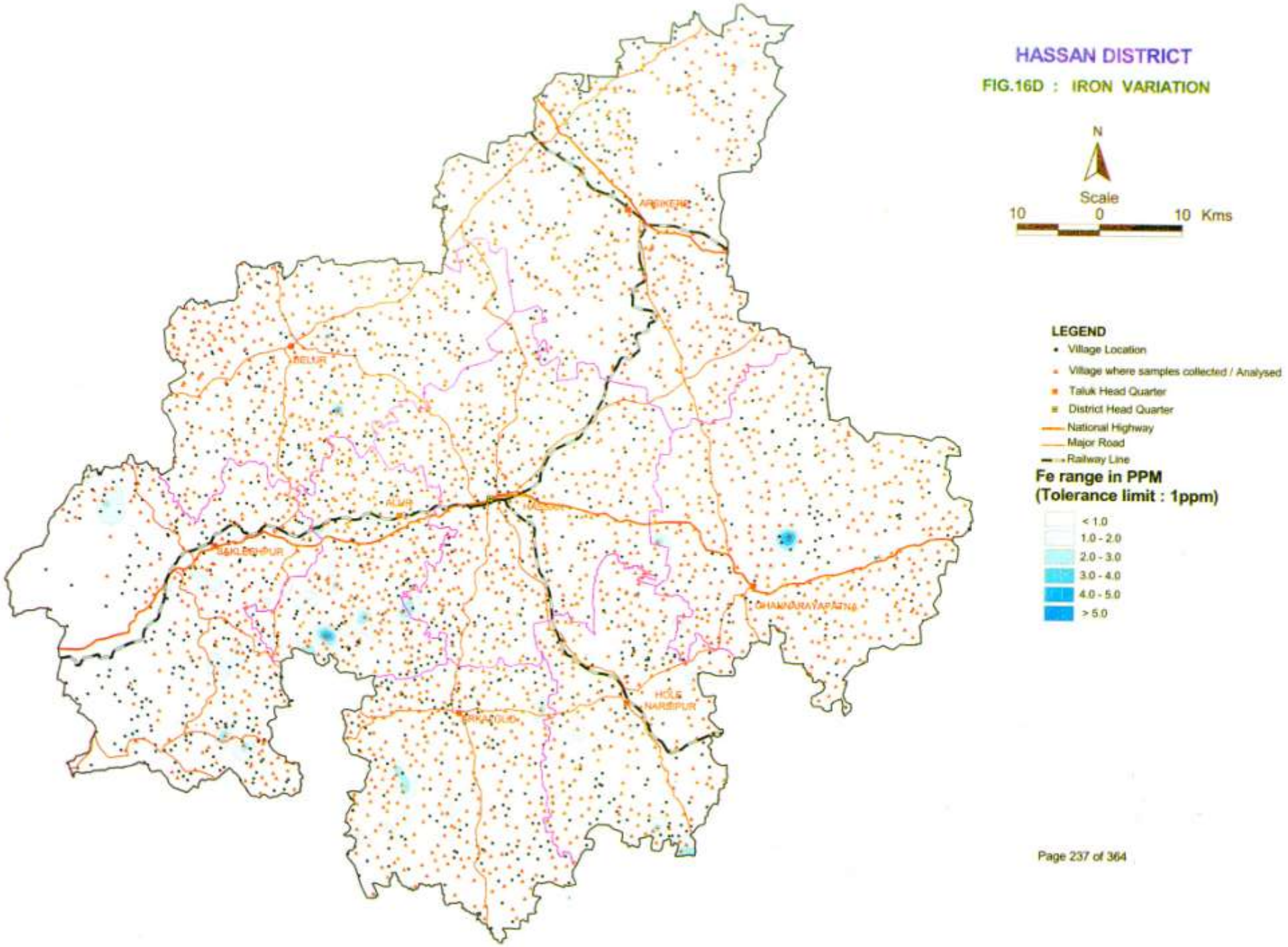
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FIG.16D : IRON VARIATION
N
Scale
10 0 10 Kms
LEGEND
Village Location
Village where samples collected / Analysed
Taluk Head Quarter
District Head Quarter
National Highway
Major Road
Railway Line
Fe range in PPM
(Tolerance limit : 1ppm)
< 1.0
1.0 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
ARSIKERE
BELUR
ALUR
SAKLESHPUR
BHANDRAVARA
HOLE NARSIPUR
ARKALGUD