

GADAG DISTRICT



FIG.14 GADAG DISTRICT

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1. Location

Gadag district is located in the central part of Karnataka State and has a geographical area of 4,657 sq. km. Gadag district is bound by Bagalkot district in the north, Dharwad district in the west, Haveri and Bellary districts in the south and Koppal district in the east. It lies between $75^{\circ} 16'$ to $76^{\circ} 03'E$ longitude and $14^{\circ} 56'$ to $15^{\circ} 53'N$ latitude. Gadag district is part of the erstwhile Dharwad District.

2. Demography

According to the 1991 census, Gadag district has a total population of 859,042. There are 350 habitations / villages. Gadag district has five taluks viz. Gadag, Mundargi, Nargund, Ron and Shirahatti.

3. Climate, Drainage and Soil

Gadag district falls in the Northern Maidan region with elevation ranging between 450 to 550 m. It is characterised by hills forming NNW trending Gadag schist belt whose tip is exposed near Gadag. Apart from these hills, rest of the area is characterised by plain lands with few isolated bouldery exposures of gneisses and lenticular patches of flat topped hills as seen near Gajendragad. Malaprabha river borders Gadag district in the northern part and Tungabhadra river borders the southeastern part. The seasonal drains like Hirehalla, Bennihalla, Sasavehalla etc. drain the district. The climate is usually arid to very warm with an average annual rainfall in the range of 500-650 mm spread over 35 to 40 rainy days. Most of the rain is received during southwest monsoon between June and September. The winters are relatively cool and summers are hot. The minimum temperature recorded during winter is $18^{\circ} C$ (during December) and highest is $42.5^{\circ}C$ recorded during May. Gadag district falls in Northern dry zone to Northern transition zone in ten fold agro-climatic classification and most part of the district has black soil with intermixed red and lateritic soils.

4. Geology and Groundwater occurrence

In Gadag district, mainly the peninsular gneisses and isolated patches of younger pink porphyritic granite amidst the vast expanse of gneisses are exposed. 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 northern most extension of Gadag-Chitradurga Schist belt consisting of conglomerate, quartzite, greywacke, limestone, metavolcanics and the iron formations is exposed in the southern part of the district. In these metasediments, the bedding planes, folds, faults and the fractures act as conduits for water movement and the solution channels especially in limestones act as groundwater repository. The schistose rocks even with well-developed schistosity are relatively impermeable, poor aquifers and yield very less quantity of water of poorer quality. Groundwater occurs mainly 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, 1461 groundwater samples collected from 336 villages/habitations in Gadag 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

There are 70 samples having higher turbidity in the range of 10.05 – 25 JTU. The samples recording higher turbidity are from: Gadag taluk (23 out of 458 samples – 10.05 to 14 JTU), Mundargi taluk (2 out of 189 samples – 13.75 & 15.75 JTU), Nargund taluk (the lone sample out of 69 samples – 10.25 JTU), Ron taluk (35 out of 383 samples – 10.5 to 25 JTU) and Shirahatti taluk (9 out of 362 samples – 10.5 to 22 JTU).

Colour

No abnormal colour intensity is recorded in the entire district.

Electrical Conductivity (EC)

In Gadag district, EC value ranges from 130 to 23340 mmhos/cm. The range of EC values reported are: Gadag taluk – 250 to 17910 mmhos/cm, Mundargi taluk- 310 to 10340 mmhos/cm, Nargund taluk – 230 to 9820 mmhos/cm, Ron taluk –160 to 23340 mmhos/cm and Shirahatti taluk - 320 to 5000 mmhos/cm. The maximum value recorded is from Ron taluk (23340 mmhos/cm) while the minimum value is recorded from Mundargi Taluk (130 mmhos/cm).

Hydrogen ion concentration (pH)

About 210 samples covering 118 villages/habitations have shown variation in pH values from acidic to basic in the range of 5.22 to 9.98. The ranges in pH values in the taluks are Gadag 5.75 - 9.98 (62 samples), Mundargi 6.45 – 9.73 (56 samples), Nargund 6.05 – 9.82 (15 samples), Ron 5.22 – 9.98 (65 samples) and Shirahatti 6.36 – 9.05 (12 samples). Both the minimum (5.22) and maximum (9.98) pH values are reported from Ron taluk.

5.2 Chemical Characters

Total Dissolved Salts (TDS)

Nearly 161 samples spread across 83 villages have indicated higher TDS ranging from 2010 to 8494 ppm. The ranges of abnormal TDS content in different taluks are: Gadag 2015 – 5352 ppm (55 samples from 21 villages), Mundargi 2091 – 8494 ppm (9 samples from 7 villages), Nargund 2045 – 8351 ppm (21 samples from 14 villages), Ron 2120 – 6630 ppm (61 samples from 29 villages) and Shirahatti 2010 – 3410 ppm (15 samples from 12 villages).

Total Hardness (TH)

In all, 293 samples covering 139 villages / habitations have higher content of TH (600.1 to 5395 ppm). The maximum variation in TH from 600.1 to 5395 ppm is seen in the Gadag taluk (118 samples from 42 villages). The ranges of TH values in other taluks are; Mundargi 641 to 4554 ppm (22 samples from 15 villages), Nargund 638 to 2172 ppm (25 samples from 16 villages), Ron 604 to 4097 ppm (93 samples from 41 villages) and Shirahatti 603 to 1537 ppm (35 samples from 25 villages).

Calcium Hardness (CaH)

In the district, 263 samples covering 136 villages / habitations have high content of CaH ranging from 202 – 7720 ppm. The abnormal samples are from Gadag (95 samples with CaH 203 – 1481 ppm), Mundargi (17 samples with CaH 218 – 1012 ppm), Nargund (25 samples with CaH 209 – 1033 ppm), Ron (88 samples with CaH 202 – 992 ppm) and Shirahatti (38 samples with CaH 203 – 7720 ppm) taluks.

Chloride (Cl)

Only 82 samples covering 48 villages / habitations have higher chloride content ranging from 1006 – 4107 ppm. The number of abnormal samples observed in the different taluks are; Gadag 1012 – 3018 ppm (22 samples from 14 villages), Mundargi 1201 – 3155 ppm (3 samples from one village), Nargund 1006 to 2533 ppm (17 samples from 11 villages), Ron 1218 – 4107 ppm (37 samples from 19 villages) and Shirahatti 1006 - 1600 ppm (from 3 villages).

Sulphate (SO₄)

In the entire district 193 samples covering 91 villages / habitations have SO₄ content ranging from 402 to 2890 ppm. These abnormal samples are from; Ron (76 samples), Shirahatti (33 samples), Gadag (47 samples), Nargund (27 samples) and Mundargi (10 samples). The maximum sulphate content (2890 ppm) is reported from Ron taluk.

Fluoride (F)

The analytical data has revealed that, 276 samples from 130 villages/habitations have shown higher fluoride content in the range of 1.55 to 4.2 ppm. The abnormal fluoride content reported from different taluks are; 1.65 to 2.25 ppm in Gadag taluk (10 out of 458 samples), 1.55 to 3.7 ppm in Mundargi taluk (65 out of 189 samples), 1.65 to 3.75 ppm in Ron taluk (117 out of 383 samples), 1.55 to 4.2 ppm in Shirahatti taluk (61 out of 362 samples) and 1.55 to 3.5 ppm in Nargund taluk (23 out of 69 samples). The highest concentration of the fluoride 4.2 ppm is reported from Shirahatti taluk.

Nitrate (NO₃)

Only one sample in the entire district has analysed NO₃ beyond the permissible limit of 100 ppm and it is in Mundargi taluk (517 ppm, 1 out of 189 samples).

Alkalinity (Alk)

About 77 samples from 42 villages in the district have excess Alkalinity in the range of 601 to 5404 ppm. Abnormality recorded in the different taluks are; Gadag 605 to 5404 ppm (18 samples from 12 villages), Mundargi 604 – 822 ppm (14 of samples from 7 villages), Ron 602 – 755 ppm (31 samples from 13 villages) and Shirahatti 601-673 ppm (14 samples from 10 villages). No abnormal alkalinity is recorded in the entire Nargund taluk.

Iron (Fe)

No abnormal iron concentration is reported in the entire Gadag district.

Bacteria (*E.coli*)

In total, 291 samples covering 159 villages / habitations have shown the presence of bacteria. The Bacterial count varies between 4-140 numbers per 100 ml. The Bacterial count noted in different taluks are; Gadag 20 –140 no.s / 100 ml (64 samples from 34 villages), Mundargi 4 – 70 no.s /100 ml (44 samples from 27 villages), Nargund 5 – 85 no.s / 100 ml (28 samples from 17 villages), Ron 5 – 50 no.s / 100 ml (94 samples from 42 villages) and Shirahatti 5 – 100 no.s / 100 ml (61 samples from 39 villages).

5.3 Spatial Variation

Bacteria

The map depicting bacterial incidence indicates that, bacteria is more commonly seen in the analysed water samples in Gadag, Ron, Mundargi and Shirahatti taluks, whereas bacterial incidence is rare in Nargund taluk. Bacterial contamination is point specific and varies considerably.

Fluoride

The isoconcentration map of Fluoride (Fig.14A) reveals that, few isolated patches having high fluoride content are seen in the north and northwestern portions comprising of Nargund, Ron and southern portion comprising of Shirahatti taluks. Southeastern portion consisting of Mundargi taluk and Gadag taluks has fluoride content within the permissible limit.

Total dissolved Salts

The isoconcentration map of TDS (Fig.14B) shows that, northern portion of the district comprising Nargund and western portion of Ron taluks, central portion consisting Gadag taluk's northern part and eastern portion encompassing northern extreme of Mundargi and southern extreme of Ron taluks show wide variation of TDS content.

Total Hardness

The map showing TH variation (Fig.14C) reveals that, few small isolated patches in the north covering eastern part of Nargund and western part of Ron taluks, northern part of Gadag taluk in the center, eastern part along the border of Mundargi taluk and small patches in the central parts of Shirahatti and Mundargi taluks have higher TH concentration.

Sulphate

Perusal of the spatial variation map (Fig.14D) indicates confinement of higher concentration of sulphate to the northern part of the district covering eastern Nargund and western Ron taluks, eastern portion of the district covering northeastern part of the Gadag taluk and a patch in the eastern portion comprising Mundargi taluk.

6. Conclusion

The water quality data of Gadag district has reflected the presence of excess Total Hardness, Fluoride, Sulphate 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. Sulphate radical is usually added to ground water mainly through the dissolution of Sulphide minerals and secondarily due to the addition of wastewater from sewerage through infiltration. Pyrite, a common sulphide mineral is known to occur as an accessory mineral in almost all rocks either acidic or basic. Water percolating through these rocks dissolves Sulphur, converted into sulphate it will be added to the ground water system. When the source of Sulphate is secondary, care has to be taken to check its infiltration. Common Sulphates can be precipitated as salts. Sulphur within permissible limit is good for

human beings as most of the treatments for skin complaints, chest and lung diseases are treated by administering sulphur drugs. Effect of concentration beyond the limit is still unknown. 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, these organisms have been introduced into the groundwater regime by the 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 Gadag 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	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	Gadag	67	64	458	No. of samples beyond permissible limit	64	23	-	-	62	55	118	95	22	47	10	-	18	-
					No. of villages affected	34	12	-	28	21	42	39	14	20	7	-	12	-	-
2	Muniryga	63	54	189	No. of samples beyond permissible limit	44	2	-	-	56	9	22	17	3	10	65	1	14	-
					No. of villages affected	27	2	-	27	7	15	14	1	7	32	1	7	-	-
3	Nargund	36	27	63	No. of samples beyond permissible limit	28	1	-	-	15	21	25	25	17	27	23	-	-	-
					No. of villages affected	17	1	-	11	14	16	15	11	14	13	-	-	-	-
4	Ron	108	99	383	No. of samples beyond permissible limit	94	35	-	-	65	61	30	88	37	76	117	-	31	-
					No. of villages affected	42	21	-	40	29	41	43	19	32	48	-	13	-	-
5	Sivani	33	32	352	No. of samples beyond permissible limit	61	9	-	-	12	15	35	38	3	33	61	-	14	-
					No. of villages affected	39	8	-	12	12	25	25	3	18	30	-	10	-	-
Total	367	336	1461	No. of samples beyond permissible limit	291	70	-	-	210	161	233	263	82	133	276	1	77	-	
				No. of villages affected	159	44	-	118	83	139	136	48	91	130	1	42	-	-	-
Range						4-140	10.05-75	-	130-23340	5.22-9.98	201-8434	6001-5395	202-7720	1008-4107	402-2891	1.55-4.2	5-7	601-5404	-

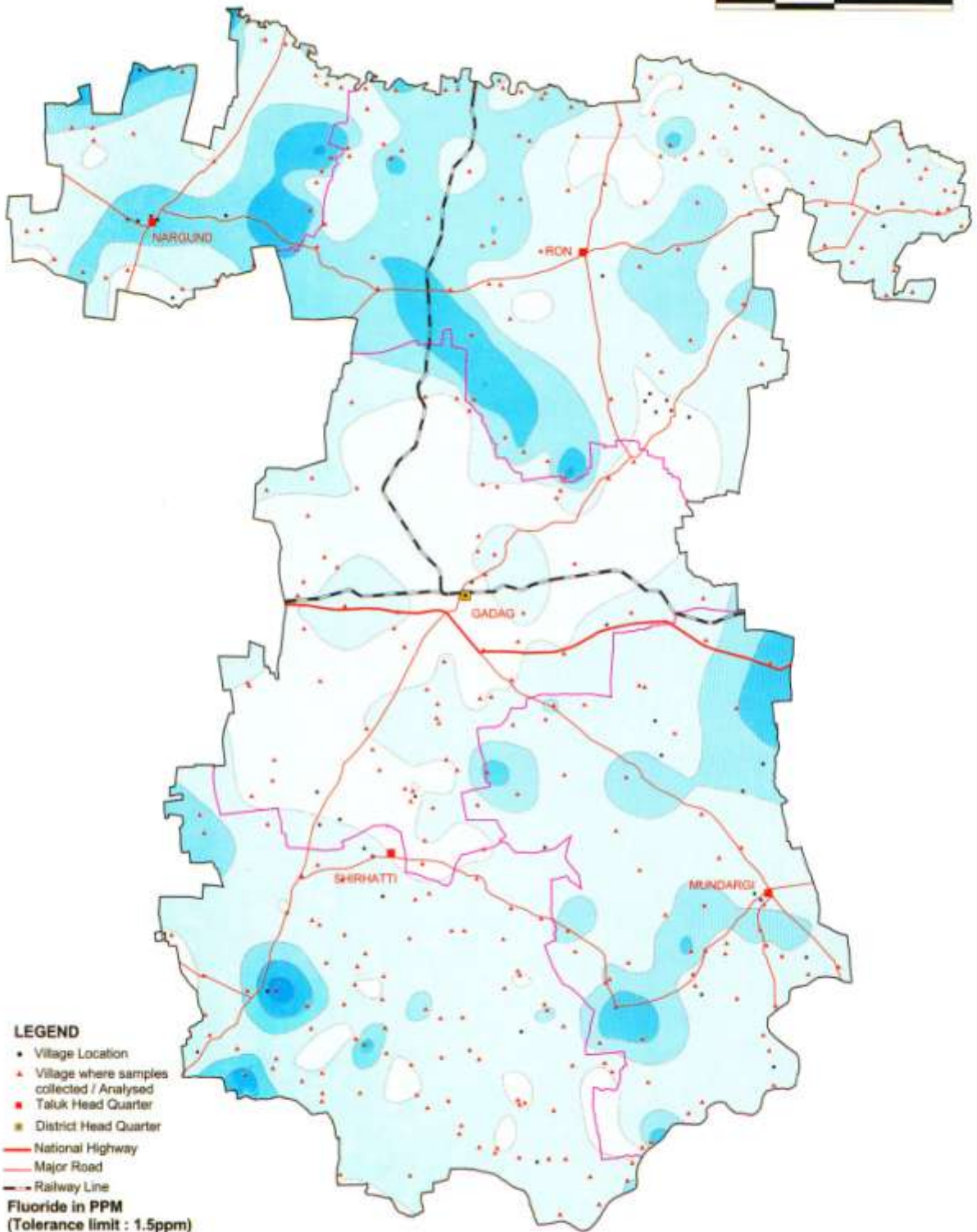
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FIG.14A : FLUORIDE VARIATION



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)

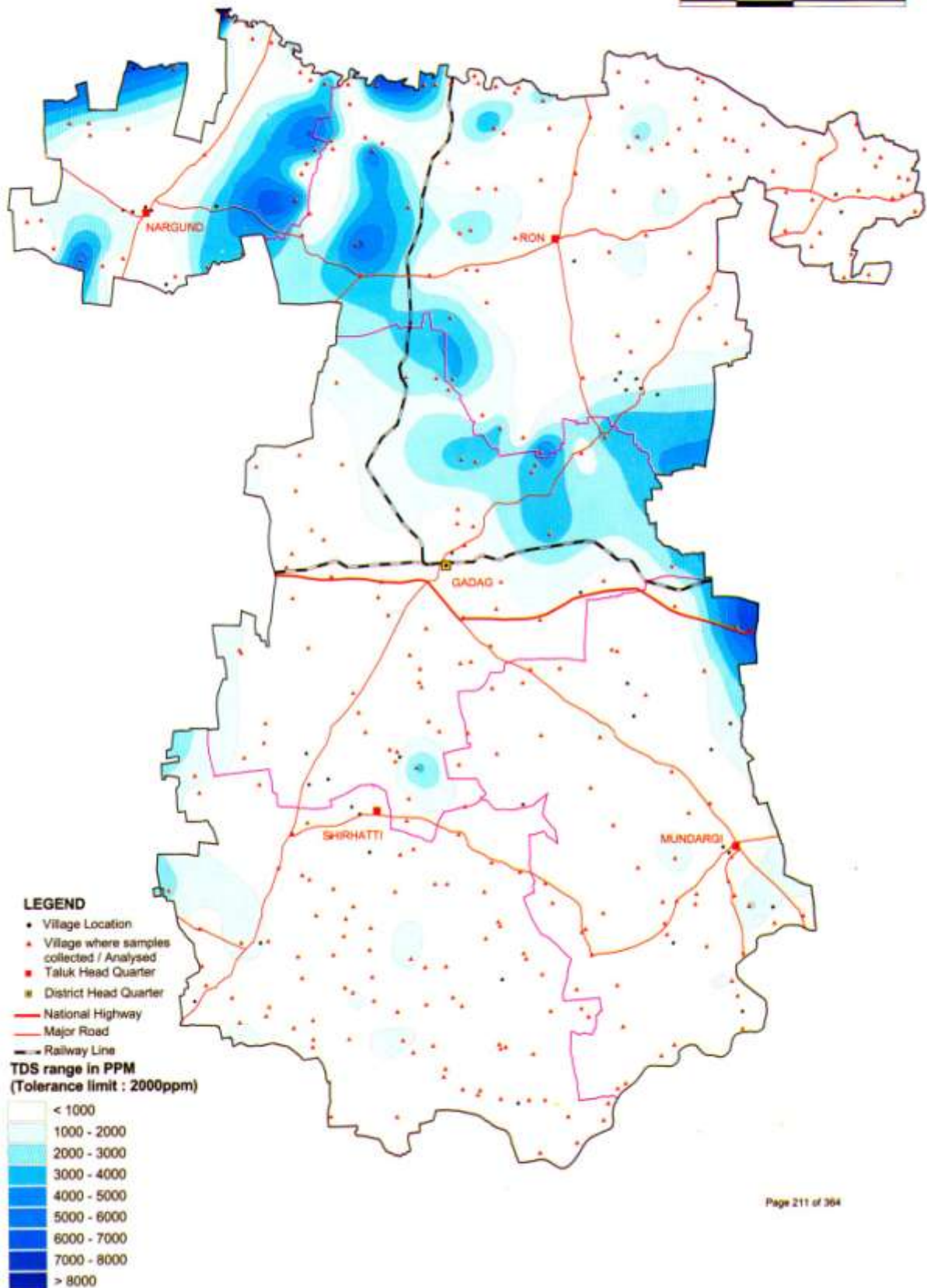
< 0.5
0.5 - 1.5
1.5 - 2.5
2.5 - 3.5
> 3.5

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FIG.14B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)



SCALE

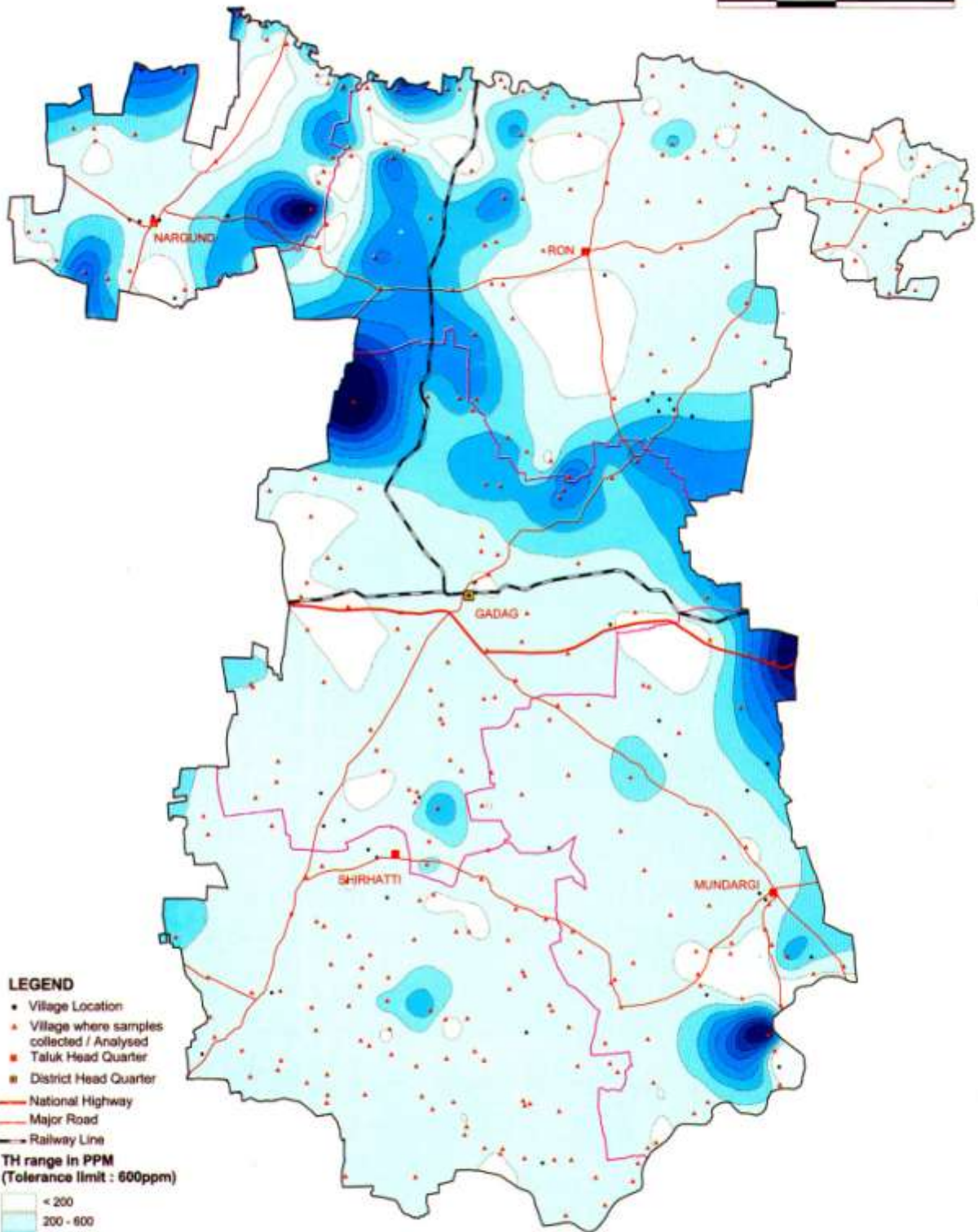


GADAG DISTRICT

FIG.14C : VARIATION OF TOTAL HARDNESS (TH)



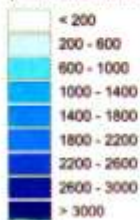
SCALE



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)



GADAG DISTRICT
FIG.14D : SULPHATE VARIATION



SCALE

