BAGALKOT DISTRICT

FIG.1 BAGALKOT DISTRICT

1. Location

Bagalkot district is located in the northwestern portion of Karnataka State with the geographical area of 6,592 sq. km. It is bounded by Bijapur district on northern side, Belgaum district on western side, Gadag district on the southern side, Koppal district on southeastern side and Raichur district on eastern side. It lies between 15° 48' to 16° 34' N Latitude and 75° 12' to 76° 21' E Longitude.

2. Demography

As per the 1991 census, Bagalkot district has a population of 1,394,542. The total number of villages / habitations in the district are 705. Bagalkot district has 6 taluks viz. Badami, Bagalkot, Bilgi, Hungund, Jamkhandi and Mudhol.

3. Climate, Drainage and Soil

Bagalkot receives rainfall from southwest monsoon during the months of June to September spread over 25 to 30 rainy days during the season. The average annual rainfall is about 544 mm. Cooler period is between November and January with December being the coolest. Summer season is spread over February to May months with May being the warmest month, during which temperature reaches up to 44°C. In general, the temperature varies between 15.4 ° to 38.5 ° C. Ghataprabha, Malaprabha and Krishna rivers drain the district and Almatti reservoir built across Krishna river and Muchakhandi tank are the major water bodies.

4. Geology and Groundwater occurrence

Bagalkot district comprises mainly the Kaladgi group of sedimentary formations including limestone, sandstone and quartzite. From the groundwater point of view, the bedding planes, folds, faults and the fractures act as conduits for water movement as well as repository of groundwater. The open spaces such as subsurface caverns/solution channels in these areas specifically in the limestone country are the characteristic features that have been developed into potential irrigation sources. The structural features control the quantity and the lithological composition of the area governs the quality. 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, 2979 groundwater samples collected from 596 villages/habitations in Bagalkot 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

In the district, 382 samples covering 252 villages/habitations show higher turbidity ranging between 10.5 and 568 JTU. The samples showing higher turbidity are from Badami (71 out of 540 samples), Bagalkot (88 out of 479 samples), Bilgi (47 out of 293 samples), Hungund (45 out of 677 samples), Jamkhandi (94 out of 613 samples) and Mudhol (37 out of 377 samples) taluks.

Arsenic

About 30 samples from 26 villages have reported the presence of Arsenic in the range of 2-20 ppm in the district. The ranges of Arsenic concentration recorded in the taluks are: Badami (13 out of 540 samples), Bagalkot (4 out of 479 samples), Bilgi (2 out of 293 samples), Jamkhandi (9 out of 613 samples) and Mudhol (2 out of 377 samples). Hungund taluk has not reported the presence of Arsenic content.

Electrical Conductivity (EC)

In Bagalkot district, the EC value ranges from 100 to 19300 mmhos/cm. The maximum value (19300 mmhos/cm) and the minimum value (100 mmhos/cm) are recorded from Hungund taluk. The range of EC values recorded in the other taluks of the district are: Badami (140 - 8430 mmhos/cm), Bagalkot (400-8300 mmhos/cm), Bilgi (260-12600 mmhos/cm), Jamkhandi (400-8900 mmhos/cm) and Mudhol (300-4200 mmhos/cm).

Hydrogen Ion Concentration (pH)

Only 36 samples have shown the fluctuation in pH value from acidic to basic in the range of 5.65 to 9.2 with highest (9.2) being reported from Jamkhandi taluk. The ranges of pH value recorded in the taluks of the district are: Badami 5.65 to 8.9 (6 samples), Bagalkot 8.54 (2 samples), Hungund 8.8 (2 samples), Jamkhandi 8.6-9.2 (16 samples) and Mudhol 8.6 to 8.9 (3 samples).

5.2 Chemical characters

Total Dissolved Salts (TDS)

In the district, 257 samples covering 132 villages / habitations have higher content of TDS in the range of 2006 to 8870 ppm. The ranges of abnormal TDS content in different taluks are: Badami 2006-5520 (53 samples), Bagalkot 2040 to 5724 (42 samples), Bilgi 2120 to 8870 (31 samples), Jamkhandi 2001 to 6365 (99 samples) and Mudhol 2006 to 5590 (32 samples). The highest value of TDS 8870 ppm is reported from Bilgi Taluk.

Total Hardness (TH)

Totally 783 samples spread across 288 villages/habitations have indicated the TH value beyond the permissible limit in the range of 602.4 to 9720 ppm. The range of TH values above the permissible limit in the other taluks are: Badami 620 to 3866 ppm (180 samples) Bagalkot 608 to 3400 ppm (139samples) Bilgi 660 to 6028 ppm (83 samples),Hungund 602 to 854.5 ppm (18 samples), Jamkhandi 612 to 4450 ppm (213 samples) and Mudhol 640 to 9720 ppm (150 samples). The maximum TH content (9720 ppm) is reported from Mudhol taluk.

Calcium Hardness (CalH)

There are 625 samples spread across 209 villages having higher CalH ranging from 201 to 2032 ppm. The abnormal samples are from: Badami (21 samples with CalH 201.6 to 736 ppm), Bagalkot (24 samples with CalH 201 to 457.6 ppm), Bilgi (17 samples with CalH 201 to 2032 ppm), Hungund (408 samples with CalH 202 to 1086 ppm), Jamkhandi (124 samples with CalH 201 to 1509 ppm) and Mudhol (31 samples with CalH 201.6 to 1040 ppm).

Chloride (Cl)

Only about 67 samples analysed from 49 villages / habitations have shown excess Cl content ranging from 1010 to 4113 ppm. The abnormal Cl content noted in the taluks of Bagalkot district are: Badami 1013-1556 ppm (10 samples), Bagalkot 1020-1600 ppm (4 samples), Bilgi 1078-4113 (10 samples), Hungund 1200-2600 ppm (9 samples), Jamkhandi 1100-2392 ppm (30 samples) and Mudhol 1010-2783 ppm (4 samples). Highest Cl content of 4113 ppm is reported from Bilgi taluk.

Sulphate (SO_4)

In the entire district, 221 samples covering 103 villages / habitations have recorded SO_4 content in the range of 402 to 3200 ppm. The more affected taluk is Jamkhandi (416 to 2712 ppm, 100 samples) followed by Mudhol (402 to 3200 ppm, 40 samples), Badami (416 to 2176 ppm, 30 samples), Bagalkot (404 to 2815 ppm, 30 samples) and Bilgi (408 to 2092 ppm, 21 samples). Hungund taluk has not reported any abnormal concentration of sulphate.

Fluoride (F)

The analytical data has revealed higher fluoride content in the range of 1.6 to 11.1 ppm in 275 samples from 134 villages / habitations. The concentrational variation in fluoride reported in different taluks are: Badami 1.7 to 6.1 ppm (66 samples), Bagalkot 1.6 to 5.1 (99 samples), Bilgi 1.76 to 4.96 ppm (55 samples), Hungund 1.7 to 11.1 ppm (26 samples), Jamkhandi 1.8 to 5.4 ppm (18 samples) and Mudhol 1.9 to 5.6 (11 samples). Highest concentration of 11.1 ppm is reported from Hungund taluk.

Nitrate (NO_3)

In all, 84 samples covering 56 villages / habitations have analysed NO_3 content beyond the permissible limit in the range of 105 to 1056 ppm. These samples are from: Badami 105 to 560 ppm (31 samples), Bagalkot 104 to 544 ppm (17 samples), Bilgi 140 to 400 ppm (5 samples), Jamkhandi 104 to 1050 ppm (20 samples) and Mudhol 108 to 1056 ppm (11 samples). Hungund taluk has not reported any abnormal concentration of Nitrate.

Alkalinity (Alk)

There are 358 samples from 122 villages analysing alkalinity in excess ranging between 608 and 2000 ppm. These are from: Badami 616 to 828 ppm (10 samples), Bagalkot 608 to 724 ppm (7 samples), Bilgi 608 to 752 ppm (6 samples), Hungund 620 to 2000 ppm (331 samples), Jamkhandi 630 to 660 ppm (3 samples) and Mudhol 739 ppm (the lone sample).

Iron (Fe)

As many as 304 samples covering 198 villages / habitations, have analysed iron in excess in the range of 1.1 to 12 ppm. The concentrational variation of iron in different taluks are: Badami 1.1 to 4 ppm (46 samples), Bagalkot 1.2 to 3.2 ppm (37 samples), Bilgi 1.2 to 3.2 ppm (18 samples), Hungund 1.2 to 12 ppm (114 samples), Jamkhandi 1.4 to 3.4 ppm (53 samples) and Mudhol 1.4 to 2.4 ppm (36 samples). The highest Fe value of 12 ppm is recorded in Hungund taluk.

Bacteria (*E.coli*)

In the district, 256 samples analysed from 173 villages/habitations have shown the presence of Bacteria with its count varying between 1 to 17 No.s /100 ml of water. The bacterial counts reported in different taluks are: Badami 1 to 2 (28 samples), Bagalkot 1 to 17 (20 samples), Bilgi 1 to 8 (39 samples), Hungund 1 to 5 (140 samples), Jamkhandi 1 to 12 (19 samples) and Mudhol 1 to 2 (10 samples).

5.3 Spatial Variation

Bacteria (*E.coli*)

The map depicting the bacterial incidence reveals those, a number of villages have indicated the presence of Bacteria. The southeastern part covering Hungund and Bagalkot taluks are comparatively more affected.

Fluoride (F)

The isoconcentration map of fluoride (Fig.1A) shows abnormal concentration of Flouride at few places. These patches are located in the northern and southern part covering Bagalkot and Bilgi and Badami taluk respectively. Isolated patches are also

observed in southwestern part covering Mudhol taluk and along eastern border in Hungund taluk

Total Dissolved Salts (TDS)

The isoconcentration map (Fig.1B) depicts that; higher concentration patches are randomly distributed and localized in the western part covering Mudhol and Jamkhandi taluks, northern part covering Bilgi and Bagalkot taluks and southern part covering Badami taluk.

Total Hardness (TH)

Isoconcentration map generated (Fig.1C) shows that, few isolated patches of varying sizes in the northern portion covering Bagalkot and Bilgi taluk, western part of the district covering Jamkhandi and Mudhol taluks, southern portion covering Badami taluk and a large patch in Jamkhandi taluk have higher concentration of TH.

Iron (Fe)

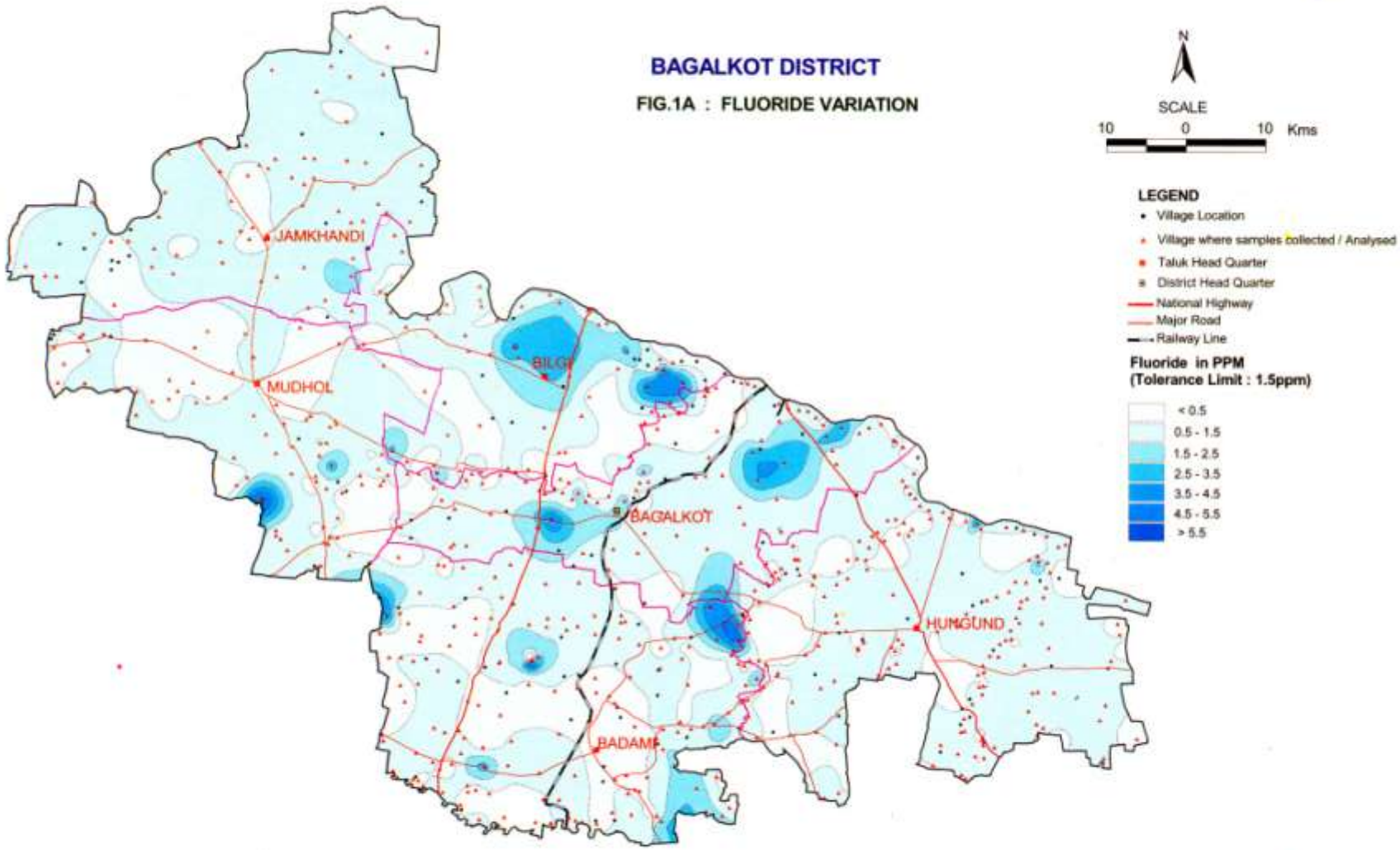
From the isoconcentration map of iron (Fig.1D) it is evident that, the district is having iron concentration within the permissible limit excepting few isolated patches in the eastern portion covering Hungund taluk, small isolated patches in the southern portion covering Badami taluk, in the northern part of Bilgi and Jamkhandi taluks and three very small patches in Mudhol taluk in the western part.

6. Conclusion

The water quality data of Bagalkot district has reflected the presence of excess Turbidity, Total Hardness, Calcium Hardness, Iron and Bacteria. Turbidity can be reduced by simple infiltration and hardness can be reduced by some conventional methods. 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, these 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.

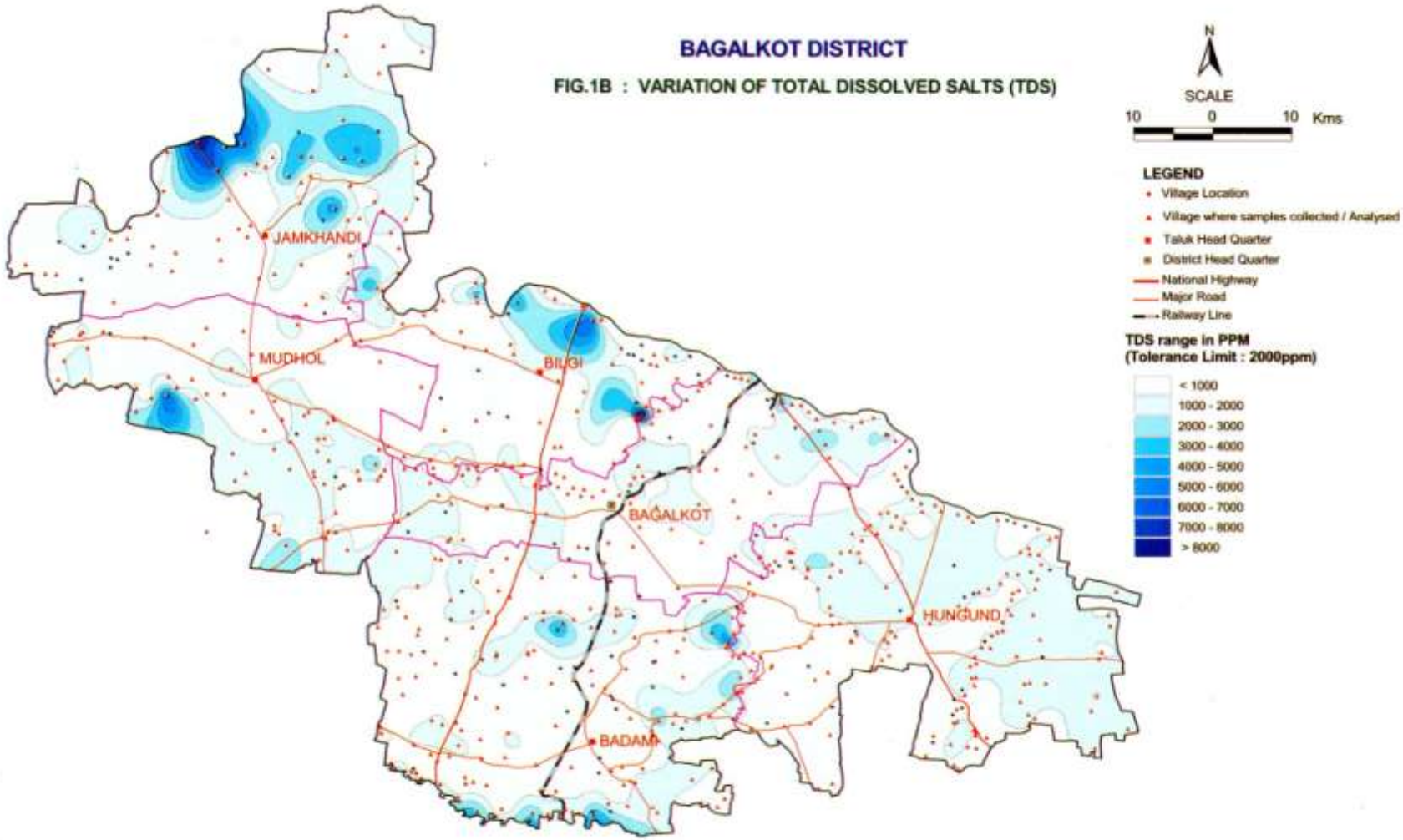
Table: Comprehensive analysis of water quality data of Bagalkot District

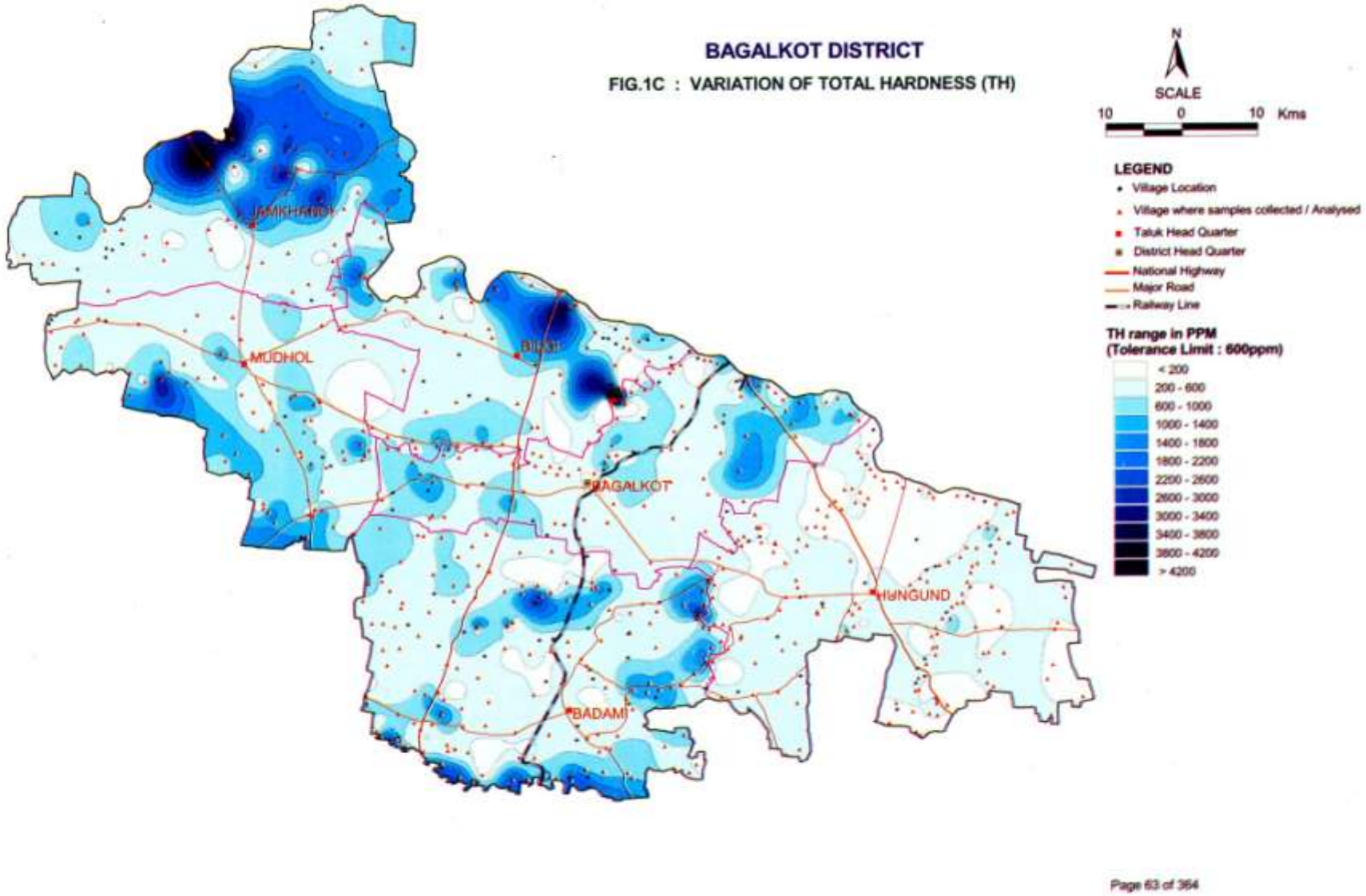
SL.NO.	Name of the taluks	Number of villages/ habitations	Number of sampled villages	Number of samples analysed	Water quality scenario	Bact (c/100 ml) -0	Tur (10) JTU	As (0.05) ppm	Cond – mmhos /cm	pH (6.5-8.5)	TDS (2000) ppm	TH (600) ppm	CalH (200) ppm	Cl (1000) ppm	SO_4 (400) ppm	F (1.5) ppm	NO_3 (100) ppm	Alk (600) ppm	Fe (1) ppm
1	Badami	177	147	540	No. of samples beyond permissible limit	28	71	13	-	6	53	180	21	10	30	66	31	10	46
					No. of villages affected	19	58	13	-	3	33	77	15	9	18	34	18	9	41
					Range	1-2	11-568	2-20	140-8430	5.65-8.9	2006-5520	620-3866	201.6-736	1013-1556	416-2176	1.7-6.1	105-560	616-828	1.1-4
2	Bagalkot	110	89	479	No. of samples beyond permissible limit	20	88	4	-	2	42	139	24	4	30	99	17	7	37
					No. of villages affected	15	54	4	-	2	26	56	17	4	15	36	11	6	24
					Range	1-17	12-276	5-6.5	400-8300	8.54	2040-5724	608-3400	201-457.6	1020-1600	404-2815	1.6-5.1	104-544	608-724	1.2-3.2
3	Bilgi	78	59	293	No. of samples beyond permissible limit	39	47	2	-	-	31	83	17	10	21	55	5	6	18
					No. of villages affected	24	29	2	-	-	17	35	10	7	12	21	5	3	12
					Range	1-8	11-100	5-10	260-12600	-	2120-8870	660-6028	201-2032	1078-4113	408-2092	1.76-4.96	140-400	608-752	1.2-3.2
4	Hungund	182	160	677	No. of samples beyond permissible limit	140	45	-	-	2	-	18	408	9	-	26	-	331	114
					No. of villages affected	91	43	-	-	2	-	11	108	8	-	24	-	100	68
					Range	1-5	10.5-90.1	-	100-19300	8.8	-	602.4-854.4	202-1086	1200-2600	-	1.7-11.1	-	620-2000	1.2-12
5	Jamkhandi	77	65	613	No. of samples beyond permissible limit	19	94	9	-	16	99	213	124	30	100	18	20	3	53
					No. of villages affected	16	46	5	-	10	36	53	44	17	36	10	15	3	27
					Range	1-12	10.5-100	5-10	400-8900	8.6-9.2	2001-6365	612-4450	201-1509	1100-2392	416-2712	1.8-5.4	104-1050	630-660	1.4-3.4
6	Mudhol	81	76	377	No. of samples beyond permissible limit	10	37	2	-	10	32	150	31	4	40	11	11	1	36
					No. of villages affected	8	22	2	-	3	20	56	15	4	22	9	7	1	26
					Range	1-2	11-120	5	300-4200	8.6-8.9	2006-5590	640-9720	201.6-1040	1010-2783	402-3200	1.9-5.6	108-1056	739	1.4-2.4
	Total	705	596	2979	No. of samples beyond permissible limit	256	382	30	-	36	257	783	625	67	221	275	84	358	304
					No. of villages affected	173	252	26	-	20	132	288	209	49	103	134	56	122	198
					Range	1-17	10.5-568	5-20	100-19300	5.56-9.2	2001-8870	602-9720	201-2032	1010-4113	402-3200	1.6-11.1	104-1056	608-2000	1.1-12

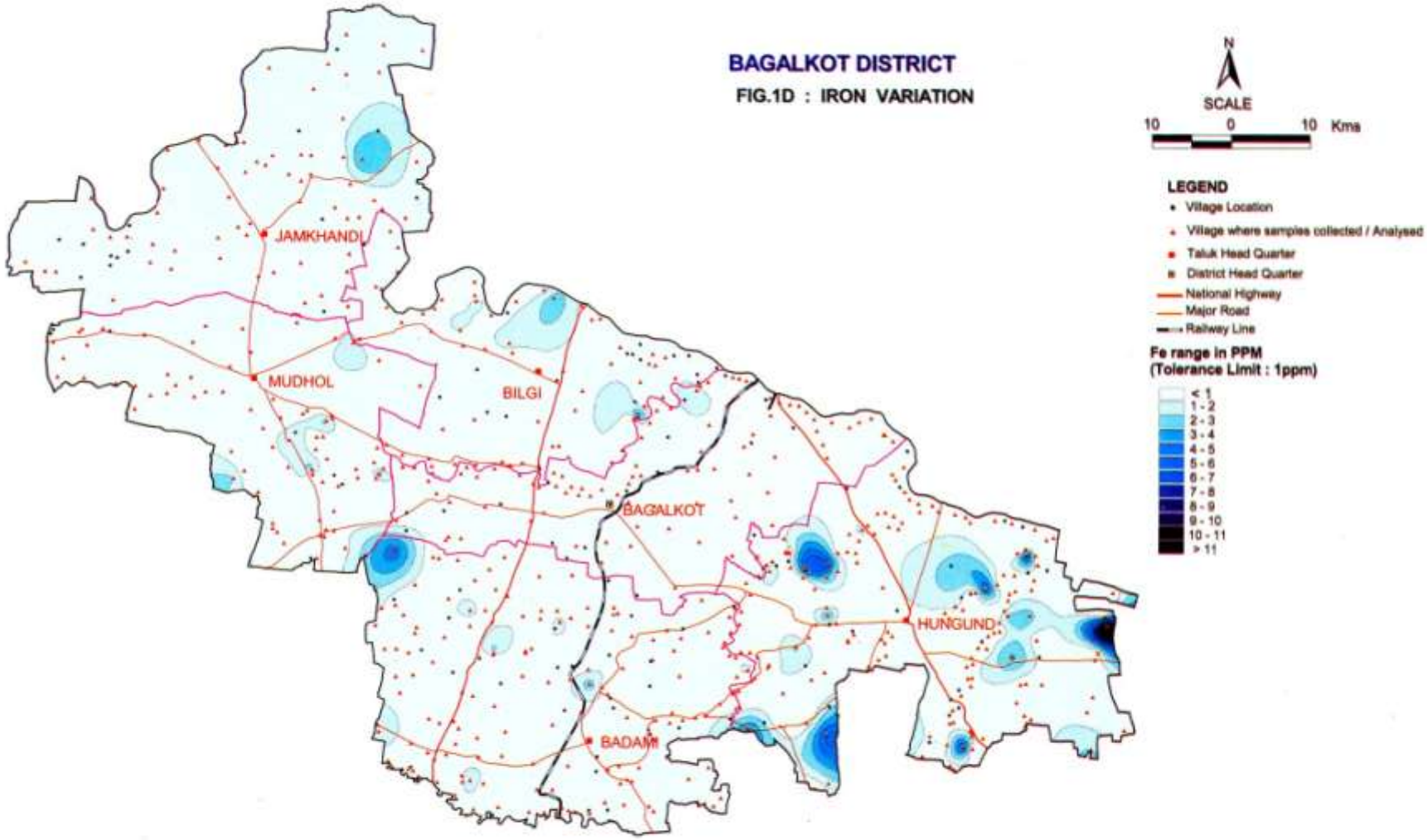

BAGALKOT DISTRICT
FIG.1A : FLUORIDE VARIATION
N
SCALE
10 0 10 Kms
LEGEND
Village Location
Village where samples collected / Analysed
Taluk Head Quarter
District Head Quarter
National Highway
Major Road
Railway Line
Fluoride in PPM
(Tolerance Limit : 1.5ppm)
< 0.5
0.5 - 1.5
1.5 - 2.5
2.5 - 3.5
3.5 - 4.5
4.5 - 5.5
> 5.5
JAMKHANDI
MUDHOL
BILGI
BAGALKOT
HUNGUND
BADAMI

BAGALKOT DISTRICT

FIG.1B : VARIATION OF TOTAL DISSOLVED SALTS (TDS)




BAGALKOT DISTRICT
FIG.1C : 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 - 2200
2200 - 2600
2600 - 3000
3000 - 3400
3400 - 3800
3800 - 4200
> 4200
JAMKHANDI
MUDHOL
BILAGI
BAGALKOT
HUNGUND
BADAMI


BAGALKOT DISTRICT
FIG.1D : 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
1 - 2
2 - 3
3 - 4
4 - 5
5 - 6
6 - 7
7 - 8
8 - 9
9 - 10
10 - 11
> 11
JAMKHANDI
MUDHOL
BILGI
BAGALKOT
HUNGUND
BADAMI