

**Table1** Location details of groundwater sampling

| S.No | Location        | Tahsil     | Lat      | Long     | Source | DOC        | WL<br>mbgl |
|------|-----------------|------------|----------|----------|--------|------------|------------|
| 1    | Hanchinal       | Sindhanur  | 15.66833 | 76.68577 | DW     | 21-01-2020 | 3.58       |
| 2    | Hanchinal       | Sindhanur  | 15.66833 | 76.68577 | BW     | 21-01-2020 |            |
| 3    | Hosahalli camp  | Sindhanur  | 15.73805 | 76.74686 | HP     | 21-01-2020 |            |
| 4    | Sindhanur       | Sindhanur  | 15.77952 | 76.76448 | DW     | 21-01-2020 | 4.20       |
| 5    | Sindhanur       | Sindhanur  | 15.77952 | 76.76448 | BW     | 21-01-2020 |            |
| 6    | Turvihal        | Sindhanur  | 15.76396 | 76.59824 | DW     | 21-01-2020 | 3.34       |
| 7    | Kalmamgi        | Sindhanur  | 15.72782 | 76.54102 | DW     | 21-01-2020 | 3.90       |
| 8    | Chikkebergi     | Sindhanur  | 15.75871 | 76.50469 | DW     | 21-01-2020 | 4.35       |
| 9    | Bhogapur        | Lingasugur | 15.76219 | 76.51653 | HP     | 21-01-2020 |            |
| 10   | Tavaregere      | Lingasugur | 15.77050 | 76.40671 | DW     | 21-01-2020 | 4.26       |
| 11   | Chattra         | Lingasugur | 15.88957 | 76.44728 | DW     | 21-01-2020 | 6.46       |
| 12   | Chattra         | Lingasugur | 15.88957 | 76.44743 | HP     | 21-01-2020 |            |
| 13   | Ulimeshwar      | Lingasugur | 15.95049 | 76.44785 | DW     | 21-01-2020 | 6.97       |
| 14   | Pikilihal       | Lingasugur | 15.96852 | 76.45023 | HP     | 22-01-2020 |            |
| 15   | KasbaLingasugur | Lingasugur | 16.12300 | 76.52549 | DW     | 22-01-2020 | 5.50       |
| 16   | Lingasugur      | Lingasugur | 16.15710 | 76.52518 | DW     | 22-01-2020 | 6.20       |
| 17   | Amereswar       | Lingasugur | 16.25519 | 76.56633 | HP     | 22-01-2020 |            |
| 18   | Devarapupur     | Lingasugur | 16.24624 | 76.58437 | DW     | 22-01-2020 | 6.35       |
| 19   | Anehousur       | Lingasugur | 16.15533 | 76.39979 | DW     | 22-01-2020 | 3.52       |
| 20   | Nagarhal        | Lingasugur | 16.08641 | 76.30495 | BW     | 22-01-2020 |            |
| 21   | Bommanal        | Lingasugur | 16.07356 | 76.34704 | DW     | 22-01-2020 | 1.46       |
| 22   | Bommanal        | Lingasugur | 16.06992 | 76.36558 | BW     | 22-01-2020 |            |
| 23   | AshihalTonda    | Lingasugur | 16.05603 | 76.38880 | BW     | 22-01-2020 |            |
| 24   | Maski           | Lingsugur  | 16.2708  | 77.2669  | DW     | 22-01-2020 | 8.55       |

|    |                |            |          |          |    |            |       |
|----|----------------|------------|----------|----------|----|------------|-------|
| 25 | Muski IB       | Lingasugur | 15.96314 | 76.65405 | BW | 22-01-2020 |       |
| 26 | Goudur         | Lingsugur  | 16.2622  | 76.6675  | DW | 22-01-2020 | 3.52  |
| 27 | Ankus Doddi    | Lingasugur | 16.03491 | 76.60782 | DW | 22-01-2020 | 7.35  |
| 28 | Chikkasarur    | Lingasugur | 16.11169 | 76.63732 | DW | 22-01-2020 | 8.62  |
| 29 | Sakthinagar    | Raichur    | 16.37195 | 77.35446 | DW | 22-01-2020 | 2.86  |
| 30 | Yelapura Road  | Raichur    | 16.34921 | 77.31781 | HP | 23-01-2020 |       |
| 31 | Hanamapur      | Devadurga  | 16.32185 | 77.22408 | BW | 23-01-2020 |       |
| 32 | Gabbur         | Devadurga  | 16.30864 | 77.16104 | BW | 23-01-2020 |       |
| 33 | Kakargal       | Devadurga  | 16.34118 | 77.05097 | DW | 23-01-2020 | 7.10  |
| 34 | Jalahalli      | Devadurga  | 16.3681  | 76.7678  | DW | 23-01-2020 | 3.48  |
| 35 | Chikkahonakuni | Devadurga  | 16.40097 | 76.98287 | DW | 23-01-2020 | 1.91  |
| 36 | Mustoor        | Devadurga  | 16.3125  | 77.0167  | DW | 23-01-2020 | 2.12  |
| 37 | Kirani/Kotigud | Devadurga  | 16.39056 | 76.95626 | HP | 23-01-2020 |       |
| 38 | Hemanur        | Devadurga  | 16.34813 | 76.95254 | DW | 23-01-2020 | 3.50  |
| 39 | Arekere        | Devadurga  | 16.27865 | 76.95425 | DW | 23-01-2020 | 7.63  |
| 40 | Galag          | Devadurga  | 16.25766 | 76.83753 | DW | 23-01-2020 | 2.87  |
| 41 | Watgal         | Manvi      | 16.1047  | 76.7506  | DW | 23-01-2020 | 10.34 |
| 42 | Chincherki     | Manvi      | 16.20131 | 76.78801 | DW | 27-01-2020 | 5.90  |
| 43 | Chincherki     | Manvi      | 16.20131 | 76.78801 | BW | 27-01-2020 |       |
| 44 | Raichur        | Raichur    | 16.20787 | 77.34708 | DW | 28-01-2020 | 5.15  |
| 45 | Raichur        | Raichur    | 16.20787 | 77.34708 | BW | 28-01-2020 |       |
| 46 | JakkalDinne    | Manvi      | 16.18156 | 77.07086 | DW | 28-01-2020 | 3.54  |
| 47 | Sirwar         | Manvi      | 16.17554 | 77.03007 | BW | 28-01-2020 |       |
| 48 | Bagalwad       | Lingsugur  | 16.2681  | 76.8842  | DW | 28-01-2020 | 3.92  |
| 49 | Jawalgera      | Sindhur    | 15.8650  | 76.8011  | DW | 28-01-2020 | 5.28  |
| 50 | Janekal        | Manvi      | 16.0153  | 76.9503  | DW | 28-01-2020 | 7.56  |
| 51 | Kurdi          | Manvi      | 16.0511  | 77.2006  | DW | 28-01-2020 | 8.26  |

|    |              |       |          |          |    |            |      |
|----|--------------|-------|----------|----------|----|------------|------|
| 52 | Manvi        | Manvi | 16.04261 | 77.13800 | BW | 28-01-2020 |      |
| 53 | Rajoli       | Manvi | 15.97892 | 77.25751 | BW | 28-01-2020 |      |
| 54 | Rajalbhandra | Manvi | 15.96402 | 77.17523 | DW | 27-01-2020 | 2.84 |

**Table 2** Details of analytical methodology and basic statistics of groundwater samples

| S. No | Variable                | Symbol           | Method                    | Units | Min  | Max   | Average | SD      | BIS prescribed limits<br>IS:10500, 2012 |                   |
|-------|-------------------------|------------------|---------------------------|-------|------|-------|---------|---------|-----------------------------------------|-------------------|
|       |                         |                  |                           |       |      |       |         |         | Desirable Limit                         | Permissible Limit |
| 1     | pH                      | pH               | Potentiometry             |       | 7.86 | 9.86  | 8.27    | 0.34    | 6.5 – 8.5                               |                   |
| 2     | Electrical conductivity | EC               | Electrolytic conductivity | µS/cm | 703  | 15280 | 3012.8  | 2992.09 |                                         |                   |
| 3     | Total Dissolved Solids  | TDS              | Gravimetric/<br>By Factor | mg/L  | 100  | 2300  | 617.72  | 528.76  | 500                                     | 2000              |
| 4     | Total hardness          | TH               | EDTA titrimetric          | mg/L  | 449  | 9779  | 1928.2  | 1914.94 | 200                                     | 600               |
| 5     | Calcium                 | Ca               | EDTA titrimetric          | mg/L  | 16   | 384   | 97.20   | 75.12   | 75                                      | 200               |
| 6     | Magnesium               | Mg               | by difference             | mg/L  | 2    | 432   | 91.17   | 93.47   | 30                                      | 100               |
| 7     | Sodium                  | Na               | Flame photometry          | mg/L  | 52   | 2490  | 381.10  | 469.80  | --                                      | --                |
| 8     | Potassium               | K                | Flame photometry          | mg/L  | 1    | 502   | 65.65   | 121.85  | --                                      | --                |
| 9     | Carbonate               | CO <sub>3</sub>  | Titrimetric               | mg/L  | 0    | 96    | 12.59   | 20.45   | --                                      | --                |
| 10    | Bicarbonate             | HCO <sub>3</sub> | Titrimetric               | mg/L  | 182  | 638   | 419.44  | 116.95  | --                                      | --                |
| 11    | Chloride                | Cl               | Argentometry              | mg/L  | 69   | 3578  | 514.55  | 670.38  | 250                                     | 1000              |

|    |          |                 |                                  |      |      |        |        |        |     |     |
|----|----------|-----------------|----------------------------------|------|------|--------|--------|--------|-----|-----|
| 12 | Sulphate | SO <sub>4</sub> | Nephlo–<br>turbidimetry          | mg/L | 18   | 1850   | 294.75 | 413.47 | 200 | 400 |
| 13 | Nitrate  | NO <sub>3</sub> | Spectrophoto<br>Metry (UV)       | mg/L | 2    | 830    | 140.30 | 183.72 | 45  | NR  |
| 14 | Fluoride | F               | Spectrophoto<br>metry-<br>SPADNS | mg/L | 0.06 | 7.20   | 2.07   | 1.71   | 1.0 | 1.5 |
| 15 | Uranium  | U               | Fluorometric                     | µg/L | 0    | 158.32 | 23.08  | 34.29  | 30  | NR  |

**Table 3** Classification of ground water based on Electrical conductivity

| <b>Electrical<br/>conductivity<br/>µS/cm, at 25° C</b> | <b>Water class</b>      | <b>No. of<br/>samples</b> | <b>Percentage</b> |
|--------------------------------------------------------|-------------------------|---------------------------|-------------------|
| <b>&lt;750</b>                                         | Fresh                   | 03                        | 5.5 %             |
| <b>751 – 2250</b>                                      | Moderately Fresh        | 30                        | 55.5 %            |
| <b>2251– 3000</b>                                      | Slightly<br>mineralized | 05                        | 9.3 %             |
| <b>&gt;3000</b>                                        | Highly<br>mineralized   | 16                        | 29.7 %            |

**Table 4** Classification of ground water based on TDS (Freeze and Cherry, 1979)

| <b>Type of water</b>  | <b>TDS range<br/>(mg/L)</b> | <b>No. of<br/>samples</b> | <b>Percentage</b> |
|-----------------------|-----------------------------|---------------------------|-------------------|
| <b>Fresh water</b>    | 0-1,000                     | 17                        | <b>31.5 %</b>     |
| <b>Brackish water</b> | 1,000-10,000                | 37                        | <b>68.5 %</b>     |
| <b>Saline water</b>   | 10,000-100,000              | Nil                       | <b>Nil</b>        |
| <b>Brine water</b>    | >100,000                    | Nil                       | <b>Nil</b>        |

**Table 5** Suitability of groundwater for drinking based on TDS (BIS,10500:2012)

| <b>TDS range<br/>(mg/L)</b> | <b>Suitability<br/>of water</b> | <b>No. of<br/>samples</b> | <b>Percentage</b> |
|-----------------------------|---------------------------------|---------------------------|-------------------|
| <b>Upto 500</b>             | Desirable for drinking          | 04                        | 7.5 %             |
| <b>501-2000</b>             | Permissible for drinking        | 35                        | 64.8 %            |
| <b>Above 2000</b>           | Unfit for drinking              | 15                        | 27.7 %            |

**Table 6** Classification of ground water based on hardness values (Sawyer & McCarty)

| <b>Total Hardness<br/>range<br/>(mg/L)</b> | <b>Water<br/>Class</b> | <b>No. of<br/>samples</b> | <b>Percentage</b> |
|--------------------------------------------|------------------------|---------------------------|-------------------|
| <b>0 – 75</b>                              | Soft                   | Nil                       | Nil               |
| <b>76 – 150</b>                            | Moderately hard        | 03                        | 5.5 %             |
| <b>151– 300</b>                            | Hard                   | 10                        | 18.5 %            |
| <b>&gt;300</b>                             | Very hard              | 41                        | 76.0 %            |

**Table 7** Suitability of groundwater for drinking based on Hardness (BIS,10500: 2012)

| <b>Water Class</b>                 | <b>Total Hardness range<br/>(mg/L)</b> | <b>No. of<br/>samples</b> | <b>Percentage</b> |
|------------------------------------|----------------------------------------|---------------------------|-------------------|
| <b>Desirable limit</b>             | <300 mg/L as CaCO <sub>3</sub>         | 13                        | 24.0 %            |
| <b>Permissible limit</b>           | 301- 600 mg /L as CaCO <sub>3</sub>    | 24                        | 44.5 %            |
| <b>Above Permissible<br/>limit</b> | >600 mg/L as CaCO <sub>3</sub>         | 17                        | 31.5 %            |

**Table 8** Suitability of groundwater for drinking based on Chloride (BIS,10500: 2012)

| Water Class                        | Chloride range<br>(mg/L) | No. of<br>samples | Percentage |
|------------------------------------|--------------------------|-------------------|------------|
| <b>Desirable limit</b>             | <250mg/L                 | 26                | 48.2 %     |
| <b>Permissible limit</b>           | 251- 1000 mg /L          | 20                | 37.0 %     |
| <b>Above Permissible<br/>limit</b> | >1000 mg/L               | 08                | 14.8 %     |

**Table 9** showing THI values for nitrate calculated using both oral and dermal HQ

| Sample<br>Number | NITRATE  |       |       |                       |                       |                       |          |       |       |
|------------------|----------|-------|-------|-----------------------|-----------------------|-----------------------|----------|-------|-------|
|                  | HQ ORAL  |       |       | HQ DERMAL             |                       |                       | THI      |       |       |
|                  | CHILDREN | WOMEN | MEN   | CHILDREN              | WOMEN                 | MEN                   | CHILDREN | WOMEN | MEN   |
| 1                | 31.13    | 23.58 | 19.95 | $1.66 \times 10^{-1}$ | $6.26 \times 10^{-2}$ | $5.30 \times 10^{-2}$ | 31.29    | 23.64 | 20.00 |
| 2                | 2.51     | 1.90  | 1.61  | $1.34 \times 10^{-2}$ | $5.06 \times 10^{-3}$ | $4.28 \times 10^{-3}$ | 2.53     | 1.91  | 1.61  |
| 3                | 4.13     | 3.13  | 2.64  | $2.20 \times 10^{-2}$ | $8.30 \times 10^{-3}$ | $7.02 \times 10^{-3}$ | 4.15     | 3.13  | 2.65E |
| 4                | 3.94     | 2.98  | 2.52  | $2.10 \times 10^{-2}$ | $7.92 \times 10^{-3}$ | $6.70 \times 10^{-3}$ | 3.96     | 2.99  | 2.53  |
| 5                | 1.69     | 1.28  | 1.08  | $9.00 \times 10^{-3}$ | $3.40 \times 10^{-3}$ | $2.87 \times 10^{-3}$ | 1.70     | 1.28  | 1.08  |
| 6                | 3.56     | 2.70  | 2.28  | $1.90 \times 10^{-2}$ | $7.17 \times 10^{-3}$ | $6.07 \times 10^{-3}$ | 3.58     | 2.71  | 2.29  |
| 7                | 1.80     | 1.36  | 1.15  | $9.60 \times 10^{-3}$ | $3.62 \times 10^{-3}$ | $3.06 \times 10^{-3}$ | 1.81     | 1.37  | 1.16  |
| 8                | 1.54     | 1.16  | 0.99  | $8.20 \times 10^{-3}$ | $3.09 \times 10^{-3}$ | $2.62 \times 10^{-3}$ | 1.55     | 1.17  | 0.99  |
| 9                | 1.50     | 1.14  | 0.96  | $8.00 \times 10^{-3}$ | $3.02 \times 10^{-3}$ | $2.55 \times 10^{-3}$ | 1.51     | 1.14  | 0.96  |
| 10               | 28.50    | 21.59 | 18.27 | $1.52 \times 10^{-1}$ | $5.73 \times 10^{-2}$ | $4.85 \times 10^{-2}$ | 28.65    | 21.65 | 18.32 |
| 11               | 5.06     | 3.84  | 3.25  | $2.70 \times 10^{-2}$ | $1.02 \times 10^{-2}$ | $8.62 \times 10^{-3}$ | 5.09     | 3.85  | 3.25  |
| 12               | 1.13     | 0.85  | 0.72  | $6.00 \times 10^{-3}$ | $2.26 \times 10^{-3}$ | $1.92 \times 10^{-3}$ | 1.13     | 0.85  | 0.72  |
| 13               | 0.94     | 0.71  | 0.60  | $5.00 \times 10^{-3}$ | $1.89 \times 10^{-3}$ | $1.60 \times 10^{-3}$ | 0.94     | 0.71  | 0.60  |
| 14               | 6.75     | 5.11  | 4.33  | $3.60 \times 10^{-2}$ | $1.36 \times 10^{-2}$ | $1.15 \times 10^{-2}$ | 6.79     | 5.13  | 4.34  |
| 15               | 5.06     | 3.84  | 3.25  | $2.70 \times 10^{-2}$ | $1.02 \times 10^{-2}$ | $8.62 \times 10^{-3}$ | 5.09     | 3.85  | 3.25  |

|    |       |       |      |                       |                       |                       |       |       |      |
|----|-------|-------|------|-----------------------|-----------------------|-----------------------|-------|-------|------|
| 16 | 4.58  | 3.47  | 2.93 | $2.44 \times 10^{-2}$ | $9.21 \times 10^{-3}$ | $7.79 \times 10^{-3}$ | 4.60  | 3.48  | 2.94 |
| 17 | 4.69  | 3.55  | 3.00 | $2.50 \times 10^{-2}$ | $9.43 \times 10^{-3}$ | $7.98 \times 10^{-3}$ | 4.71  | 3.56  | 3.01 |
| 18 | 3.38  | 2.56  | 2.16 | $1.80 \times 10^{-2}$ | $6.79 \times 10^{-3}$ | $5.75 \times 10^{-3}$ | 3.39  | 2.56  | 2.17 |
| 19 | 10.13 | 7.67  | 6.49 | $5.40 \times 10^{-2}$ | $2.04 \times 10^{-2}$ | $1.72 \times 10^{-2}$ | 10.18 | 7.69  | 6.51 |
| 20 | 1.50  | 1.14  | 0.96 | $8.00 \times 10^{-3}$ | $3.02 \times 10^{-3}$ | $2.55 \times 10^{-3}$ | 1.51  | 1.14  | 0.96 |
| 21 | 10.31 | 7.81  | 6.61 | $5.50 \times 10^{-2}$ | $2.08 \times 10^{-2}$ | $1.76 \times 10^{-2}$ | 10.37 | 7.83  | 6.63 |
| 22 | 4.31  | 3.27  | 2.76 | $2.30 \times 10^{-2}$ | $8.68 \times 10^{-3}$ | $7.34 \times 10^{-3}$ | 4.34  | 3.28  | 2.77 |
| 23 | 0.09  | 0.07  | 0.06 | $5.00 \times 10^{-4}$ | $1.89 \times 10^{-4}$ | $1.60 \times 10^{-4}$ | 0.09  | 0.07  | 0.06 |
| 24 | 5.21  | 3.95  | 3.34 | $2.78 \times 10^{-2}$ | $1.05 \times 10^{-2}$ | $8.87 \times 10^{-3}$ | 5.24  | 3.96  | 3.35 |
| 25 | 4.95  | 3.75  | 3.17 | $2.64 \times 10^{-2}$ | $9.96 \times 10^{-3}$ | $8.43 \times 10^{-3}$ | 4.98  | 3.76  | 3.18 |
| 26 | 6.11  | 4.63  | 3.92 | $3.26 \times 10^{-2}$ | $1.23 \times 10^{-2}$ | $1.04 \times 10^{-2}$ | 6.15  | 4.64  | 3.93 |
| 27 | 9.19  | 6.96  | 5.89 | $4.90 \times 10^{-2}$ | $1.85 \times 10^{-2}$ | $1.56 \times 10^{-2}$ | 9.24  | 6.98  | 5.91 |
| 28 | 7.88  | 5.97  | 5.05 | $4.20 \times 10^{-2}$ | $1.58 \times 10^{-2}$ | $1.34 \times 10^{-2}$ | 7.92  | 5.98  | 5.06 |
| 29 | 0.08  | 0.06  | 0.05 | $4.00 \times 10^{-4}$ | $1.51 \times 10^{-4}$ | $1.28 \times 10^{-4}$ | 0.08  | 0.06  | 0.05 |
| 30 | 3.53  | 2.67  | 2.26 | $1.88 \times 10^{-2}$ | $7.09 \times 10^{-3}$ | $6.00 \times 10^{-3}$ | 3.54  | 2.68  | 2.27 |
| 31 | 3.19  | 2.41  | 2.04 | $1.70 \times 10^{-2}$ | $6.41 \times 10^{-3}$ | $5.43 \times 10^{-3}$ | 3.20  | 2.42  | 2.05 |
| 32 | 14.44 | 10.94 | 9.25 | $7.70 \times 10^{-2}$ | $2.91 \times 10^{-2}$ | $2.46 \times 10^{-2}$ | 14.51 | 10.97 | 9.28 |
| 33 | 0.75  | 0.57  | 0.48 | $4.00 \times 10^{-3}$ | $1.51 \times 10^{-3}$ | $1.28 \times 10^{-3}$ | 0.75  | 0.57  | 0.48 |
| 34 | 2.51  | 1.90  | 1.61 | $1.34 \times 10^{-2}$ | $5.06 \times 10^{-3}$ | $4.28 \times 10^{-3}$ | 2.53  | 1.91  | 1.61 |
| 35 | 0.38  | 0.28  | 0.24 | $2.00 \times 10^{-3}$ | $7.55 \times 10^{-4}$ | $6.38 \times 10^{-4}$ | 0.38  | 0.28  | 0.24 |
| 36 | 0.17  | 0.13  | 0.11 | $8.80 \times 10^{-4}$ | $3.32 \times 10^{-4}$ | $2.81 \times 10^{-4}$ | 0.17  | 0.13  | 0.11 |
| 37 | 0.08  | 0.06  | 0.05 | $4.20 \times 10^{-4}$ | $1.58 \times 10^{-4}$ | $1.34 \times 10^{-4}$ | 0.08  | 0.06  | 0.05 |
| 38 | 8.06  | 6.11  | 5.17 | $4.30 \times 10^{-2}$ | $1.62 \times 10^{-2}$ | $1.37 \times 10^{-2}$ | 8.11  | 6.12  | 5.18 |
| 39 | 2.33  | 1.76  | 1.49 | $1.24 \times 10^{-2}$ | $4.68 \times 10^{-3}$ | $3.96 \times 10^{-3}$ | 2.34  | 1.77  | 1.49 |
| 40 | 0.56  | 0.43  | 0.36 | $3.00 \times 10^{-3}$ | $1.13 \times 10^{-3}$ | $9.58 \times 10^{-4}$ | 0.57  | 0.43  | 0.36 |

|                              |       |       |       |                       |                       |                       |       |       |       |
|------------------------------|-------|-------|-------|-----------------------|-----------------------|-----------------------|-------|-------|-------|
| 41                           | 1.05  | 0.80  | 0.67  | $5.60 \times 10^{-3}$ | $2.11 \times 10^{-3}$ | $1.79 \times 10^{-3}$ | 1.06  | 0.80  | 0.67  |
| 42                           | 2.93  | 2.22  | 1.88  | $1.56 \times 10^{-2}$ | $5.89 \times 10^{-3}$ | $4.98 \times 10^{-3}$ | 2.94  | 2.22  | 1.88  |
| 43                           | 1.24  | 0.94  | 0.79  | $6.60 \times 10^{-3}$ | $2.49 \times 10^{-3}$ | $2.11 \times 10^{-3}$ | 1.24  | 0.94  | 0.80  |
| 44                           | 2.06  | 1.56  | 1.32  | $1.10 \times 10^{-2}$ | $4.15 \times 10^{-3}$ | $3.51 \times 10^{-3}$ | 2.07  | 1.57  | 1.33  |
| 45                           | 3.56  | 2.70  | 2.28  | $1.90 \times 10^{-2}$ | $7.17 \times 10^{-3}$ | $6.07 \times 10^{-3}$ | 3.58  | 2.71  | 2.29  |
| 46                           | 29.63 | 22.44 | 18.99 | $1.58 \times 10^{-1}$ | $5.96 \times 10^{-2}$ | $5.04 \times 10^{-2}$ | 29.78 | 22.50 | 19.04 |
| 47                           | 3.19  | 2.41  | 2.04  | $1.70 \times 10^{-2}$ | $6.41 \times 10^{-3}$ | $5.43 \times 10^{-3}$ | 3.20  | 2.42  | 2.05  |
| 48                           | 2.96  | 2.24  | 1.90  | $1.58 \times 10^{-2}$ | $5.96 \times 10^{-3}$ | $5.04 \times 10^{-3}$ | 2.98  | 2.25  | 1.90  |
| 49                           | 0.86  | 0.65  | 0.55  | $4.60 \times 10^{-3}$ | $1.74 \times 10^{-3}$ | $1.47 \times 10^{-3}$ | 0.87  | 0.66  | 0.55  |
| 50                           | 2.51  | 1.90  | 1.61  | $1.34 \times 10^{-2}$ | $5.06 \times 10^{-3}$ | $4.28 \times 10^{-3}$ | 2.53  | 1.91  | 1.61  |
| 51                           | 9.86  | 7.47  | 6.32  | $5.26 \times 10^{-2}$ | $1.98 \times 10^{-2}$ | $1.68 \times 10^{-2}$ | 9.92  | 7.49  | 6.34  |
| 52                           | 0.45  | 0.34  | 0.29  | $2.40 \times 10^{-3}$ | $9.05 \times 10^{-4}$ | $7.66 \times 10^{-4}$ | 0.45  | 0.34  | 0.29  |
| 53                           | 14.40 | 10.91 | 9.23  | $7.68 \times 10^{-2}$ | $2.90 \times 10^{-2}$ | $2.45 \times 10^{-2}$ | 14.48 | 10.94 | 9.26  |
| 54                           | 1.80  | 1.36  | 1.15  | $9.60 \times 10^{-3}$ | $3.62 \times 10^{-3}$ | $3.06 \times 10^{-3}$ | 1.81  | 1.37  | 1.16  |
| Min                          | 0.08  | 0.06  | 0.05  | $4.00 \times 10^{-4}$ | $1.51 \times 10^{-4}$ | $1.28 \times 10^{-4}$ | 0.08  | 0.06  | 0.05  |
| Max                          | 31.13 | 23.58 | 19.95 | $1.66 \times 10^{-1}$ | $6.26 \times 10^{-2}$ | $5.30 \times 10^{-2}$ | 31.29 | 23.64 | 20.00 |
| No of<br>samples<br>affected | 44    | 41    | 38    | 0                     | 0                     | 0                     | 44    | 41    | 38    |
| %<br>Affected                | 81%   | 76%   | 70%   | 0%                    | 0%                    | 0%                    | 81%   | 76%   | 70%   |

**Table 10** showing THI values for fluoride calculated using both oral and dermal HQ

| Sample number | FLUORIDE |       |      |                       |                        |                       |          |       |      |
|---------------|----------|-------|------|-----------------------|------------------------|-----------------------|----------|-------|------|
|               | HQ ORAL  |       |      | HQ DERMAL             |                        |                       | THI      |       |      |
|               | CHILDREN | WOMEN | MEN  | CHILDREN              | WOMEN                  | MEN                   | CHILDREN | WOMEN | MEN  |
| 1             | 2.96     | 2.24  | 1.89 | $1.58 \times 10^{-2}$ | $5.946 \times 10^{-3}$ | $5.03 \times 10^{-3}$ | 2.97     | 2.24  | 1.90 |
| 2             | 6.75     | 5.11  | 4.33 | $3.60 \times 10^{-2}$ | $1.358 \times 10^{-2}$ | $1.15 \times 10^{-2}$ | 6.79     | 5.13  | 4.34 |
| 3             | 2.40     | 1.82  | 1.54 | $1.28 \times 10^{-2}$ | $4.829 \times 10^{-3}$ | $4.09 \times 10^{-3}$ | 2.41     | 1.82  | 1.54 |
| 4             | 2.03     | 1.53  | 1.30 | $1.08 \times 10^{-2}$ | $4.075 \times 10^{-3}$ | $3.45 \times 10^{-3}$ | 2.04     | 1.54  | 1.30 |
| 5             | 1.76     | 1.33  | 1.13 | $9.36 \times 10^{-3}$ | $3.531 \times 10^{-3}$ | $2.99 \times 10^{-3}$ | 1.76     | 1.33  | 1.13 |
| 6             | 1.59     | 1.20  | 1.02 | $8.48 \times 10^{-3}$ | $3.199 \times 10^{-3}$ | $2.71 \times 10^{-3}$ | 1.60     | 1.21  | 1.02 |
| 7             | 2.40     | 1.82  | 1.54 | $1.28 \times 10^{-2}$ | $4.829 \times 10^{-3}$ | $4.09 \times 10^{-3}$ | 2.41     | 1.82  | 1.54 |
| 8             | 0.29     | 0.22  | 0.18 | $1.52 \times 10^{-3}$ | $5.735 \times 10^{-4}$ | $4.85 \times 10^{-4}$ | 0.29     | 0.22  | 0.18 |
| 9             | 1.01     | 0.76  | 0.64 | $5.36 \times 10^{-3}$ | $2.022 \times 10^{-3}$ | $1.71 \times 10^{-3}$ | 1.01     | 0.76  | 0.65 |
| 10            | 7.20     | 5.45  | 4.62 | $3.84 \times 10^{-2}$ | $1.449 \times 10^{-2}$ | $1.23 \times 10^{-2}$ | 7.24     | 5.47  | 4.63 |
| 11            | 4.95     | 3.75  | 3.17 | $2.64 \times 10^{-2}$ | $9.960 \times 10^{-3}$ | $8.43 \times 10^{-3}$ | 4.98     | 3.76  | 3.18 |
| 12            | 5.10     | 3.86  | 3.27 | $2.72 \times 10^{-2}$ | $1.026 \times 10^{-2}$ | $8.68 \times 10^{-3}$ | 5.13     | 3.87  | 3.28 |
| 13            | 6.60     | 5.00  | 4.23 | $1.35 \times 10^{-2}$ | $5.108 \times 10^{-4}$ | $4.26 \times 10^{-4}$ | 6.60     | 5.00  | 4.23 |
| 14            | 7.65     | 5.80  | 4.90 | $8.00 \times 10^{-4}$ | $3.018 \times 10^{-4}$ | $2.48 \times 10^{-4}$ | 7.65     | 5.80  | 4.90 |
| 15            | 1.53     | 1.16  | 0.98 | $1.07 \times 10^{-4}$ | $4.051 \times 10^{-5}$ | $3.28 \times 10^{-5}$ | 1.53     | 1.16  | 0.98 |
| 16            | 1.82     | 1.38  | 1.16 | $9.58 \times 10^{-5}$ | $3.616 \times 10^{-5}$ | $2.88 \times 10^{-5}$ | 1.82     | 1.38  | 1.16 |
| 17            | 2.69     | 2.03  | 1.72 | $1.14 \times 10^{-4}$ | $4.288 \times 10^{-5}$ | $3.37 \times 10^{-5}$ | 2.69     | 2.03  | 1.72 |
| 18            | 1.85     | 1.40  | 1.18 | $6.52 \times 10^{-5}$ | $2.459 \times 10^{-5}$ | $1.90 \times 10^{-5}$ | 1.85     | 1.40  | 1.18 |
| 19            | 3.26     | 2.47  | 2.09 | $9.86 \times 10^{-5}$ | $3.721 \times 10^{-5}$ | $2.84 \times 10^{-5}$ | 3.26     | 2.47  | 2.09 |
| 20            | 3.26     | 2.47  | 2.09 | $8.64 \times 10^{-5}$ | $3.258 \times 10^{-5}$ | $2.45 \times 10^{-5}$ | 3.26     | 2.47  | 2.09 |
| 21            | 1.67     | 1.26  | 1.07 | $3.93 \times 10^{-5}$ | $1.482 \times 10^{-5}$ | $1.10 \times 10^{-5}$ | 1.67     | 1.26  | 1.07 |

|    |       |      |      |                     |                      |                     |       |      |      |
|----|-------|------|------|---------------------|----------------------|---------------------|-------|------|------|
| 22 | 3.51  | 2.66 | 2.25 | $7.46\times10^{-5}$ | $2.814\times10^{-5}$ | $2.06\times10^{-5}$ | 3.51  | 2.66 | 2.25 |
| 23 | 5.76  | 4.36 | 3.69 | $1.11\times10^{-4}$ | $4.199\times10^{-5}$ | $3.04\times10^{-5}$ | 5.76  | 4.36 | 3.69 |
| 24 | 1.88  | 1.42 | 1.20 | $3.32\times10^{-5}$ | $1.253\times10^{-5}$ | $8.95\times10^{-6}$ | 1.88  | 1.42 | 1.20 |
| 25 | 1.32  | 1.00 | 0.85 | $2.16\times10^{-5}$ | $8.147\times10^{-6}$ | $5.74\times10^{-6}$ | 1.32  | 1.00 | 0.85 |
| 26 | 5.12  | 3.88 | 3.28 | $7.77\times10^{-5}$ | $2.932\times10^{-5}$ | $2.04\times10^{-5}$ | 5.12  | 3.88 | 3.28 |
| 27 | 4.70  | 3.56 | 3.01 | $6.66\times10^{-5}$ | $2.512\times10^{-5}$ | $1.73\times10^{-5}$ | 4.70  | 3.56 | 3.01 |
| 28 | 0.72  | 0.55 | 0.46 | $9.58\times10^{-6}$ | $3.613\times10^{-6}$ | $2.45\times10^{-6}$ | 0.72  | 0.55 | 0.46 |
| 29 | 1.95  | 1.48 | 1.25 | $2.44\times10^{-5}$ | $9.210\times10^{-6}$ | $6.18\times10^{-6}$ | 1.95  | 1.48 | 1.25 |
| 30 | 4.25  | 3.22 | 2.72 | $5.02\times10^{-5}$ | $1.894\times10^{-5}$ | $1.25\times10^{-5}$ | 4.25  | 3.22 | 2.72 |
| 31 | 1.80  | 1.36 | 1.15 | $2.02\times10^{-5}$ | $7.609\times10^{-6}$ | $4.98\times10^{-6}$ | 1.80  | 1.36 | 1.15 |
| 32 | 1.25  | 0.94 | 0.80 | $1.33\times10^{-5}$ | $5.000\times10^{-6}$ | $3.24\times10^{-6}$ | 1.25  | 0.94 | 0.80 |
| 33 | 5.03  | 3.81 | 3.22 | $5.10\times10^{-5}$ | $1.922\times10^{-5}$ | $1.23\times10^{-5}$ | 5.03  | 3.81 | 3.22 |
| 34 | 8.25  | 6.25 | 5.29 | $7.99\times10^{-5}$ | $3.013\times10^{-5}$ | $1.90\times10^{-5}$ | 8.25  | 6.25 | 5.29 |
| 35 | 6.30  | 4.77 | 4.04 | $5.83\times10^{-5}$ | $2.201\times10^{-5}$ | $1.38\times10^{-5}$ | 6.30  | 4.77 | 4.04 |
| 36 | 10.07 | 7.63 | 6.45 | $8.93\times10^{-5}$ | $3.370\times10^{-5}$ | $2.08\times10^{-5}$ | 10.07 | 7.63 | 6.45 |
| 37 | 1.98  | 1.50 | 1.27 | $1.69\times10^{-5}$ | $6.364\times10^{-6}$ | $3.89\times10^{-6}$ | 1.98  | 1.50 | 1.27 |
| 38 | 10.80 | 8.18 | 6.92 | $8.85\times10^{-5}$ | $3.338\times10^{-5}$ | $2.02\times10^{-5}$ | 10.80 | 8.18 | 6.92 |
| 39 | 6.03  | 4.57 | 3.87 | $4.76\times10^{-5}$ | $1.795\times10^{-5}$ | $1.07\times10^{-5}$ | 6.03  | 4.57 | 3.87 |
| 40 | 2.76  | 2.09 | 1.77 | $2.10\times10^{-5}$ | $7.922\times10^{-6}$ | $4.69\times10^{-6}$ | 2.76  | 2.09 | 1.77 |
| 41 | 0.94  | 0.71 | 0.60 | $6.91\times10^{-6}$ | $2.607\times10^{-6}$ | $1.53\times10^{-6}$ | 0.94  | 0.71 | 0.60 |
| 42 | 0.09  | 0.07 | 0.06 | $6.39\times10^{-7}$ | $2.411\times10^{-7}$ | $1.40\times10^{-7}$ | 0.09  | 0.07 | 0.06 |
| 43 | 0.77  | 0.58 | 0.49 | $5.26\times10^{-6}$ | $1.984\times10^{-6}$ | $1.14\times10^{-6}$ | 0.77  | 0.58 | 0.49 |
| 44 | 0.11  | 0.08 | 0.07 | $6.99\times10^{-7}$ | $2.638\times10^{-7}$ | $1.50\times10^{-7}$ | 0.11  | 0.08 | 0.07 |
| 45 | 0.83  | 0.63 | 0.53 | $5.33\times10^{-6}$ | $2.010\times10^{-6}$ | $1.13\times10^{-6}$ | 0.83  | 0.63 | 0.53 |
| 46 | 1.70  | 1.28 | 1.09 | $1.06\times10^{-5}$ | $4.008\times10^{-6}$ | $2.23\times10^{-6}$ | 1.70  | 1.28 | 1.09 |

|                              |       |      |      |                       |                        |                       |       |      |      |
|------------------------------|-------|------|------|-----------------------|------------------------|-----------------------|-------|------|------|
| 47                           | 1.98  | 1.50 | 1.27 | $1.21 \times 10^{-5}$ | $4.548 \times 10^{-6}$ | $2.50 \times 10^{-6}$ | 1.98  | 1.50 | 1.27 |
| 48                           | 1.37  | 1.04 | 0.88 | $8.11 \times 10^{-6}$ | $3.058 \times 10^{-6}$ | $1.67 \times 10^{-6}$ | 1.37  | 1.04 | 0.88 |
| 49                           | 1.98  | 1.50 | 1.27 | $1.14 \times 10^{-5}$ | $4.302 \times 10^{-6}$ | $2.32 \times 10^{-6}$ | 1.98  | 1.50 | 1.27 |
| 50                           | 0.30  | 0.23 | 0.19 | $1.67 \times 10^{-6}$ | $6.284 \times 10^{-7}$ | $3.36 \times 10^{-7}$ | 0.30  | 0.23 | 0.19 |
| 51                           | 0.59  | 0.45 | 0.38 | $3.25 \times 10^{-6}$ | $1.225 \times 10^{-6}$ | $6.48 \times 10^{-7}$ | 0.59  | 0.45 | 0.38 |
| 52                           | 0.74  | 0.56 | 0.47 | $3.92 \times 10^{-6}$ | $1.477 \times 10^{-6}$ | $7.74 \times 10^{-7}$ | 0.74  | 0.56 | 0.47 |
| 53                           | 2.15  | 1.63 | 1.38 | $1.12 \times 10^{-5}$ | $4.207 \times 10^{-6}$ | $2.18 \times 10^{-6}$ | 2.15  | 1.63 | 1.38 |
| 54                           | 1.77  | 1.34 | 1.13 | $8.98 \times 10^{-6}$ | $3.389 \times 10^{-6}$ | $1.74 \times 10^{-6}$ | 1.77  | 1.34 | 1.13 |
| Min                          | 0.09  | 0.07 | 0.06 | $6.39 \times 10^{-7}$ | $2.411 \times 10^{-7}$ | $1.40 \times 10^{-7}$ | 0.09  | 0.07 | 0.06 |
| Max                          | 10.80 | 8.18 | 6.92 | $3.84 \times 10^{-2}$ | $1.449 \times 10^{-2}$ | $1.23 \times 10^{-2}$ | 10.80 | 8.18 | 6.92 |
| No of<br>samples<br>affected | 44    | 41   | 39   | 0                     | 0                      | 0                     | 44    | 42   | 39   |
| %<br>Affected                | 81%   | 76%  | 72%  | 0%                    | 0%                     | 0%                    | 81%   | 78%  | 72%  |