**Supplementary material**

Table 1. Physico-chemical parameters and chemistry of groundwater in the aquifer. Below detection limit: < DL

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Well** | **pH** | **EC** | **T** | **Alk.** | **DO** | **Ca** | **Mg** | **K** | **Na** | **HCO3** | **Cl** | **SO4** | **NO3** | **Si** | **Fe** |
|  |  | **(µS/cm)** | **(°C)** | **as CaCO3** | **(mg/L) (μg/L)** | | | | | | | | | | |
| North | | | | | | | | | | | | | | | |
| SGMP13 | 7.1 | 220 | 28.8 | 101.7 | 2.9 | 27.7 | 4.7 | 7.1 | 8.2 | 122.0 | 4.2 | 5.1 | 0.2 | 9.5 | <DL |
| SGMP15 | 6.5 | 293 | 28.6 | 137.3 | 4.4 | 38.2 | 7.2 | 8.5 | 11.5 | 164.7 | 3.7 | 7.3 | 1.0 | 11.3 | <DL |
| SGMP25 | 7.1 | 238 | 28.7 | 111.8 | 5.3 | 32.1 | 4.7 | 6.4 | 7.8 | 134.2 | 3.7 | 7.8 | <DL | 11.2 | 0.3 |
| SGMP26 | 7.4 | 324 | 28.5 | 127.1 | 3.0 | 33.8 | 5.8 | 6.5 | 8.1 | 152.5 | 4.2 | 0.3 | 2.3 | 10.4 | 0.2 |
| SGMP32 | 7.1 | 269 | 30.4 | 122 | 2.3 | 32.7 | 5.4 | 6.4 | 8.2 | 146.4 | 3.6 | 5.6 | 0.2 | 12.8 | 1.9 |
| SGMP39 | 7.0 | 240 | 29.6 | 127.1 | 3.1 | 29.8 | 5.7 | 6.5 | 8.7 | 152.5 | 3.8 | 7.5 | <DL | 13.0 | 2.2 |
| South | | | | | | | | | | | | | | | |
| SGMP01 | 6.4 | 260 | 28.3 | 106.8 | 1.6 | 25.6 | 5.0 | 6.2 | 17.4 | 128.1 | 6.6 | 18.9 | <DL | 13.8 | 1.4 |
| SGMP02 | 6.7 | 194 | 28.7 | 86.4 | 1.6 | 13.8 | 2.9 | 8.4 | 8.7 | 103.7 | 3.3 | 1.4 | 2.5 | 24.5 | 6.1 |
| SGMP03 | 6.9 | 195 | 29.6 | 86.4 | 1.6 | 22.4 | 3.9 | 6.8 | 8.8 | 103.7 | 4.1 | 7.0 | 1.2 | 13.6 | 1.5 |
| SGMP04 | 7.1 | 222 | 28.5 | 91.5 | 2.3 | 16.6 | 4.5 | 5.9 | 9.7 | 109.8 | 3.0 | 1.4 | 4.8 | <DL | <DL |
| SGMP05 | 6.5 | 167 | 28.9 | 66.1 | 2.7 | 11.9 | 3.0 | 5.4 | 11.1 | 79.3 | 1.0 | 1.4 | <DL | 31.5 | 0.9 |
| SGMP06 | 7.0 | 266 | 29.8 | 101.7 | 1.4 | 9.3 | 2.1 | 5.1 | 30.8 | 122.0 | 8.0 | 10.4 | <DL | 32.4 | 12.4 |
| SGMP07 | 6.9 | 197 | 28.3 | 101.7 | 2.5 | 15.2 | 4.2 | 5.4 | 11.2 | 122.0 | 1.7 | 2.5 | <DL | 23.6 | 5.3 |
| SGMP09 | 6.6 | 483 | 27.9 | 106.8 | 1.7 | 35.5 | 10.5 | 5.5 | 33.6 | 128.1 | 4.8 |  | 0.2 | 18.0 | 20.2 |
| SGMP10 | 6.5 | 548 | 29.5 | 218.6 | 0.9 | 44.5 | 12.5 | 8.3 | 32.2 | 262.3 | 13.9 | 51.2 | <DL | 12.8 | <DL |
| SGMP11 | 6.0 | 258 | 29.3 | 106.8 | 2.6 | 10.1 | 2.0 | 8.7 | 27.8 | 128.1 | 7.3 | 3.9 | <DL | 19.1 | 12.5 |
| SGMP17 | 6.8 | 248 | 29.1 | 116.9 | 2.5 | 27.2 | 5.7 | 4.8 | 11.7 | 140.3 | 3.1 | 5.5 | <DL | 16.3 | 1.8 |
| SGMP19 | 6.6 | 317 | 29.4 | 167.8 | 1.5 | 31.1 | 8.8 | 15.4 | 19.1 | 201.3 | 0.6 | 0.2 | <DL | 37.1 | 1.0 |
| SGMP20 | 6.6 | 164 | 29.9 | 86.4 | 4.4 | 12.8 | 4.3 | 10.1 | 9.9 | 103.7 | 0.5 | 0.5 | <DL | 35.0 | 0.1 |
| SGMP21 | 6.5 | 171 | 28.7 | 101.7 | 1.8 | 12.6 | 2.7 | 4.9 | 13.1 | 122.0 | 1.4 | 1.4 | <DL | 30.2 | 6.8 |
| SGMP22 | 6.8 | 441 | 27.4 | 127.1 | 4.2 | 36.0 | 11.4 | 6.4 | 10.6 | 152.5 | 4.8 | 27.1 | 0.3 | 18.9 | 8.8 |
| SGMP23 | 7.0 | 233 | 27.6 | 96.6 | 3.4 | 28.0 | 4.6 | 6.1 | 8.2 | 115.9 | 3.3 | 6.4 | 0.1 | 12.2 | 1.4 |
| SGMP27 | 6.3 | 330 | 29.7 | 50.8 | 5.3 | 4.6 | 1.5 | 13.9 | 4.9 | 61.0 | 1.0 | 0.3 | <DL | 31.3 | 0.6 |
| SGMP28 | 6.6 | 338 | 29.7 | 137.3 | 1.7 | 29.9 | 6.2 | 9.9 | 17.7 | 164.7 | 9.3 | 19.6 | <DL | 20.2 | 15.7 |
| SGMP29 | 6.7 | 233 | 29.3 | 111.8 | 4.6 | 25.9 | 4.2 | 7.0 | 9.1 | 134.2 | 3.6 | 4.9 | 0.3 | 19.7 | 7.0 |
| SGMP34 | 6.3 | 347 | 29.3 | 132.2 | 4.0 | 17.8 | 8.5 | 5.6 | 25.4 | 158.6 | 25.9 | 2.2 | <DL | 43.3 | 17.5 |
| SGMP36 | 6.3 | 119 | 29.3 | 61 | 3.0 | 6.8 | 2.6 | 8.5 | 8.4 | 73.2 | 1.4 | 0.8 | <DL | 27.8 | 3.9 |
| SGMP37 | 5.5 | 90 | 28.7 | 35.6 | 2.2 | 6.1 | 2.2 | 11.6 | 3.7 | 42.7 | 2.5 | 0.3 | 3.6 | 27.5 | <DL |
| SGMP38 | 6.8 | 277 | 29.8 | 137.3 | 3.7 | 32.2 | 6.1 | 6.1 | 12.3 | 164.7 | 3.8 | 6.1 | <DL | 21.0 | 6.3 |

Table 2. Wells sampled for noble gas analysis. Basic information is also given.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Well**  **code** | **Location**  **E N** | | **Screen interval**  **(m)** | **Well depth**  **(m)** | **Aquifer**  **layer** |
| North | | | | | |
| SGMP26 | 16.436466 | 99.544776 | 21 – 23 | 25 | Mid |
| SGMP32 | 16.434953 | 99.531780 | 15 – 19 | 24 | Mid |
| South | | | | | |
| SGMP01 | 16.406369 | 99.535430 | 13 – 16 | 29 | Shallow |
| SGMP02 | 16.404782 | 99.533927 | 21 – 23 | 23 | Mid |
| SGMP03 | 16.404638 | 99.533908 | 11 – 15 | 21 | Shallow |
| SGMP04 | 16.399696 | 99.532696 | 20 – 22 | 22 | Mid |
| SGMP10 | 16.407841 | 99.539677 | 15 – 23 | 25 | Mid |
| SGMP22 | 16.409351 | 99.542959 | 19 – 21 | 30 | Mid |
| SGMP23 | 16.417621 | 99.543469 | 17 – 19 | 30 | Mid |
| SGMP29 | 16.404063 | 99.528831 | 20 – 26 | 27 | Mid |
| SGMP30 | 16.404340 | 99.530199 | 8 – 12 | 25 | Shallow |
| SGMP38 | 16.418816 | 99.528749 | 40 – 56 | 60 | Deep |

Table 3. Stable isotope ratios (in ‰ vs V-SMOW) in groundwater (SGMP) and river water (SW) samples. na - not analysed. Measurement errors for δ2H and δ18O are 1.5 and 0.5 ‰, respectively.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sample Code** | **δ18O (MAY)** | **δ2H (MAY)** | **δ18O (JUL)** | **δ2H (JUL)** | **δ18O (DEC)** | **δ2H (DEC)** |
| North | | | | | | |
| SGMP13 | -3.7 | -31.5 | -4.7 | -35.1 | -4.8 | -35.8 |
| SGMP15 | -3.4 | -28.2 | -4.2 | -31.3 | -5.1 | -38.4 |
| SGMP25 | -4.9 | -39.0 | -5.7 | -42.4 | -5.5 | -40.2 |
| SGMP26 | -3.8 | -32.1 | -4.7 | -35.5 | -5.1 | -37.2 |
| SGMP32 | -4.9 | -38.7 | -5.6 | -41.9 | -5.7 | -41.6 |
| SGMP39 | -4.9 | -38.8 | -5.7 | -42.8 | na | na |
| South | | | | | | |
| SGMP01 | -7.4 | -54.4 | -7.9 | -54.7 | -7.6 | -53.0 |
| SGMP02 | -5.5 | -42.6 | -6.3 | -45.6 | -6.1 | -44.2 |
| SGMP03 | -4.8 | -38.4 | -5.6 | -41.1 | -4.9 | -36.6 |
| SGMP04 | -5.5 | -41.9 | -6.3 | -44.9 | -6.3 | -44.9 |
| SGMP05 | -6.4 | -47.1 | -7.1 | -50.1 | -7.1 | -49.7 |
| SGMP06 | -6.0 | -45.5 | -6.9 | -48.9 | -7.1 | -49.6 |
| SGMP07 | -5.4 | -41.9 | -6.2 | -45.1 | na | na |
| SGMP09 | -6.6 | -48.3 | -7.3 | -51.2 | -7.4 | -51.2 |
| SGMP10 | -5.9 | -45.8 | -6.7 | -49.0 | -6.6 | -47.4 |
| SGMP11 | -4.2 | -35.4 | -5.2 | -39.1 | na | na |
| SGMP17 | -4.9 | -38.2 | -5.8 | -41.7 | -5.8 | -41.9 |
| SGMP19 | -6.5 | -50.2 | -7.4 | -53.5 | -7.7 | -53.5 |
| SGMP20 | -7.1 | -52.4 | -7.8 | -55.4 | -7.7 | -54.5 |
| SGMP21 | -6.0 | -45.6 | -6.7 | -48.5 | na | na |
| SGMP22 | -5.6 | -43.1 | -6.5 | -46.7 | -6.6 | -46.9 |
| SGMP23 | -5.0 | -39.6 | -6.0 | -43.5 | -6.1 | -43.3 |
| SGMP27 | -7.5 | -54.8 | -8.2 | -58.3 | -8.1 | -57.1 |
| SGMP28 | -2.7 | -23.7 | -3.6 | -27.3 | na | na |
| SGMP29 | -4.9 | -37.5 | -5.6 | -40.5 | -4.7 | -35.6 |
| SGMP34 | -6.3 | -46.3 | -7.1 | -50.0 | -7.1 | -49.5 |
| SGMP36 | -6.2 | -46.5 | -7.1 | -50.4 | -6.9 | -48.9 |
| SGMP37 | -7.2 | -52.2 | -8.0 | -56.1 | -7.6 | -53.9 |
| SGMP38 | -5.4 | -41.8 | -6.2 | -45.3 | -6.0 | -44.3 |
| Surface water | | | | | | |
| KSP1 (SW) | -3.9 | -31.6 | -4.8 | -35.8 | -5.8 | -41.8 |
| KSP2 (SW) | -3.7 | -30.0 | -4.7 | -35.4 | -5.5 | -39.7 |

Table 4. 14C activities and 13C content in the total dissolved inorganic carbon of the groundwater samples. na: not analysed.

|  |  |  |
| --- | --- | --- |
| **Well** | **14C** | **δ13C** |
|  | **[pMC]** | **(‰ VPDB)** |
| SGMP13 | na | -12.1 |
| SGMP15 | na | na |
| SGMP25 | na | -11.4 |
| SGMP26 | na | na |
| SGMP32 | na | -13.1 |
| SGMP39 | na | -13.2 |
| SGMP01 | 96.6 ± 6.4 | -16.4 |
| SGMP02 | na | na |
| SGMP03 | na | na |
| SGMP04 | na | na |
| SGMP05 | na | na |
| SGMP06 | na | -14.3 |
| SGMP07 | na | na |
| SGMP09 | 112.8 ± 2.5 | -15.9 |
| SGMP10 | na | na |
| SGMP11 | na | na |
| SGMP17 | na | na |
| SGMP19 | na | na |
| SGMP20 | na | na |
| SGMP21 | na | na |
| SGMP22 | na | -13.9 |
| SGMP23 | na | na |
| SGMP24 | na | na |
| SGMP27 | na | na |
| SGMP28 | na | na |
| SGMP29 | na | na |
| SGMP30 | na | na |
| SGMP34 | na | -20.9 |
| SGMP36 | na | -17.0 |
| SGMP37 | 89.0 ± 1.4 | na |
| SGMP38 | 119.6 ± 7.1 | na |

**Figure 1. Spatial distribution of the Na concentration in groundwater samples from the investigated area.**

