# *TABLES*

# Table 2.1.1 Climatological Summary
## (1988/89 - 1993/94)

**RAINFALL** — Unit : mm

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | 14.6 | 41.0 | 61.2 | 39.8 | 34.2 | 58.7 | 68.6 | 96.9 | 22.3 | 11.4 | 3.9 | 3.1 | 455.8 |
| 4104 HAD COURT | 11.7 | 55.4 | 85.8 | 62.7 | 31.9 | 63.8 | 54.9 | 59.6 | 22.1 | 12.2 | 0.0 | 0.8 | 460.8 |
| 5128 MJAARA | 10.3 | 61.9 | 102.5 | 75.4 | 27.6 | 71.5 | 61.5 | 74.6 | 23.6 | 11.2 | 0.5 | 1.1 | 521.5 |
| 6153 OULED YAACOUB | 14.8 | 79.8 | 127.0 | 98.7 | 47.4 | 91.5 | 64.1 | 95.7 | 36.2 | 6.3 | 0.2 | 0.9 | 662.6 |
| 6200 OURTZAGH | 10.9 | 71.1 | 110.1 | 74.4 | 33.6 | 73.7 | 75.6 | 92.8 | 23.8 | 12.6 | 2.0 | 0.7 | 581.2 |
| 8440 TISSA | 8.6 | 41.2 | 67.4 | 43.2 | 23.4 | 51.8 | 54.9 | 61.5 | 19.4 | 7.3 | 0.0 | 0.7 | 379.3 |

**AIR TEMPERATURE** — Unit : °C

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | 24.9 | 19.6 | 18.4 | 14.1 | 12.9 | 14.5 | 15.8 | 18.9 | 21.1 | 22.6 | 27.0 | 28.4 | 19.8 |
| 4104 HAD COURT | 25.1 | 19.9 | 15.1 | 12.3 | 10.4 | 11.9 | 14.7 | 15.3 | 18.8 | 22.4 | 27.4 | 27.8 | 18.4 |
| 5128 MJAARA | 25.1 | 19.0 | 14.9 | 11.9 | 9.3 | 12.0 | 14.7 | 15.0 | 19.4 | 23.2 | 28.7 | 28.1 | 18.4 |
| 6153 OULED YAACOUB | 25.6 | 20.3 | 16.5 | 14.4 | 12.3 | 14.3 | 15.9 | 16.1 | 20.5 | 23.1 | 29.8 | 29.1 | 19.8 |
| 6200 OURTZAGH | 27.2 | 20.9 | 16.4 | 13.2 | 11.1 | 13.5 | 16.1 | 16.5 | 21.6 | 25.4 | 31.2 | 30.5 | 20.3 |
| 8440 TISSA | 26.0 | 19.9 | 15.4 | 12.4 | 10.1 | 12.4 | 15.2 | 15.7 | 20.3 | 23.6 | 30.4 | 30.0 | 19.3 |

**EVAPORATION : PAN** — Unit : mm/day

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | 8.6 | 5.8 | 6.4 | 4.1 | 5.0 | 5.2 | 6.1 | 6.4 | 7.9 | 9.3 | 11.2 | 10.8 | 7.2 |
| 4104 HAD COURT | | | | | | (N.A.) | | | | | | | |
| 5128 MJAARA | | | | | | (N.A.) | | | | | | | |
| 6153 OULED YAACOUB | | | | | | (N.A.) | | | | | | | |
| 6200 OURTZAGH | 7.3 | 3.8 | 2.3 | 1.8 | 1.8 | 2.3 | 3.1 | 3.2 | 5.5 | 7.7 | 9.9 | 9.4 | 4.9 |
| 8440 TISSA | | | | | | (N.A.) | | | | | | | |

**RELATIVE HUMIDITY** — Unit : %

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | 46 | 54 | 61 | 67 | 69 | 63 | 59 | 56 | 46 | 39 | 35 | 38 | 53 |
| 4104 HAD COURT | 60 | 67 | 73 | 77 | 78 | 77 | 75 | 72 | 65 | 65 | 57 | 58 | 69 |
| 5128 MJAARA | 61 | 74 | 81 | 83 | 82 | 82 | 80 | 77 | 72 | 68 | 61 | 61 | 73 |
| 6153 OULED YAACOUB | 62 | 70 | 73 | 73 | 70 | 71 | 68 | 74 | 61 | 64 | 51 | 54 | 66 |
| 6200 OURTZAGH | 51 | 67 | 77 | 81 | 76 | 70 | 68 | 70 | 59 | 53 | 43 | 45 | 64 |
| 8440 TISSA | 53 | 73 | 83 | 84 | 82 | 79 | 73 | 71 | 63 | 53 | 42 | 42 | 67 |

**WIND VELOCITY (MEAN)** — Unit : m/sec

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | | | | | | (N.A.) | | | | | | | |
| 4104 HAD COURT | 2.3 | 2.1 | 1.9 | 1.7 | 1.4 | 1.8 | 1.9 | 2.0 | 1.9 | 1.9 | 2.3 | 2.4 | 2.0 |
| 5128 MJAARA | 1.3 | 1.0 | 0.6 | 0.5 | 0.4 | 0.8 | 1.0 | 1.2 | 1.3 | 1.6 | 1.6 | 1.6 | 1.1 |
| 6153 OULED YAACOUB | 2.2 | 1.9 | 2.0 | 1.5 | 1.4 | 2.0 | 2.0 | 2.1 | 2.1 | 2.1 | 2.2 | 2.3 | 2.0 |
| 6200 OURTZAGH | 1.6 | 1.5 | 1.6 | 2.0 | 2.2 | 2.1 | 2.0 | 1.5 | 1.7 | 1.5 | 1.8 | 1.7 | 1.8 |
| 8440 TISSA | 2.4 | 1.9 | 1.8 | 1.9 | 1.8 | 2.2 | 2.2 | 2.0 | 2.3 | 2.3 | 2.6 | 2.4 | 2.1 |

**WIND VELOCITY (AYEERAGE MAX.)** — Unit : m/sec

| NO. STATION | SEPT | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1564 BAB MERZOUKA | | | | | | (N.A.) | | | | | | | |
| 4104 HAD COURT | 4.2 | 4.7 | 4.3 | 5.0 | 2.8 | 4.7 | 4.5 | 4.2 | 3.5 | 2.9 | 4.2 | 3.9 | 5.0 |
| 5128 MJAARA | 2.5 | 3.1 | 2.6 | 2.7 | 1.7 | 3.6 | 3.3 | 3.4 | 2.9 | 2.7 | 3.0 | 2.9 | 3.6 |
| 6153 OULED YAACOUB | 3.9 | 4.6 | 4.6 | 4.2 | 3.8 | 5.3 | 5.2 | 4.0 | 3.6 | 4.1 | 3.7 | 3.8 | 5.3 |
| 6200 OURTZAGH | 3.2 | 3.5 | 3.7 | 4.9 | 4.2 | 4.1 | 4.3 | 3.6 | 4.1 | 3.5 | 3.7 | 3.5 | 4.9 |
| 8440 TISSA | 4.7 | 4.9 | 5.2 | 5.5 | 4.6 | 5.0 | 5.3 | 5.3 | 5.0 | 5.3 | 5.2 | 4.9 | 5.5 |

Source : AH

## Table 2.1.3 RUNOFF RATE

| River System | Gauging Station | Average, 1957/58 - 1993/94 (37 Years) | | | Typical Drought Year *1 (Corresponding to 10-year Drought) | | |
|---|---|---|---|---|---|---|---|
| | | Rainfall (mm) | Runoff Depth (mm) | Runoff Rate | Rainfall (mm) | Runoff Depth (mm) | Runoff Rate |
| Rdat | Had Kourt | 726 | 129 | 0.178 | 532 | 15 | 0.027 |
| Ouergha | Bab Ouender | 788 | 319 | 0.405 | 485 | 80 | 0.164 |
| | Pont du Sker | 954 | 541 | 0.567 | 526 | 152 | 0.290 |
| | Rhafsai | 1124 | 506 | 0.450 | 723 | 100 | 0.138 |
| | Ourtzagh | 918 | 401 | 0.437 | 569 | 75 | 0.132 |
| | Tafrant | 1046 | 550 | 0.526 | 620 | 146 | 0.236 |
| | M'Jaara | 930 | 418 | 0.449 | 574 | 96 | 0.167 |
| Lebene | Tissa | 723 | 239 | 0.330 | 466 | 53 | 0.114 |
| Inaouen | Bab Merzouka | 733 | 144 | 0.196 | 474 | 22 | 0.047 |
| | El Kouchat | 726 | 162 | 0.223 | 470 | 38 | 0.081 |

Note *1 : Typical Drought Year

| | |
|---|---|
| Rdat | : 1991/92 |
| Ouergha | : 1991/92 |
| Lebene | : 1988/89 |
| Inaouen | : 1988/89 |

## Table 2.1.5 Hydrogeological Characteristics of Groundwater Potential Structures (1/2)

| Geological Structures | | | Structure Coordinates | | | Water Bearing Formations | | Water Potential (estimated) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Ground Water Exploration | | | |
| No. | Location | Type | X | Y | Z (m) | Epoch or Stage | Lithology | Spring | No. of Wells Proposed | Depth (m) | Estimated Productivity (l/s) | Water Quality |
| | Mountainous Water potential Structures | | | | | | | | | | | |
| 1 | J. Tainaste | Flexure | 616000 to 617000 | 440000 to 442500 | 1100 to 1300 | Quaternary<br>Jurassic<br>Bajocian-upper Lias<br>Middle Lias | Recent Alluvium<br>Limestone & Marly Limestone<br>Limestone & Dolomite | 5- Springs<br>Flow Rate Ranges<br>between 15-85 m3/d | 1<br>1<br>1 | 125<br>100<br>75 | Ranges between<br>2 - 5<br>5 - 7<br>2 - 5 | Chemically Acceptable |
| 2 | J. Khamise | Monocline | 599000 to 600500 | 427500 to 428700 | 700-800 | Jurassic<br>Bajocian-upper Lias | Limestone & Marly Limestone<br>Limestone and Dolomite | 5- Springs<br>Flow Rate Ranges<br>between 15 - 50 m3/d | 1<br>1 | 150<br>125 | Ranges between<br>5 - 10<br>3 - 7 | Ditto |
| 3 | J. Lakhdar<br>( Keil Mountain) | Monocline | 577200 to 581500 | 435500 to 440750 | 600-700 | Jurassic<br>Bajocian-upper Lias<br>Middle Lias | Limestone & Marly Limestone<br>Limestone & Dolomite | 8- Springs<br>Flow Rate Ranges<br>between 15-60m3/d<br>One Spring w/ Large<br>Flowrate-Bou Adel<br>220 l/s | 1<br>1<br>1 | 150<br>150<br>100 | Ranges between<br>3 - 10<br>10 - 20<br>2 - 3 | Ditto |
| 4 | J. Berda | Monocline | 547000 to 550500 | 447000 to 448500 | 750-850 | Jurassic<br>Bajocian-upper Lias<br>Middle Lias | Limestone & Marly Limestone<br>Limestone & Dolomite | 3- Springs<br>Flow Rate Ranges<br>between 20-700 m3/d | 1<br>1<br>1<br>1 | 100<br>125<br>125<br>150 | Ranges between<br>1 - 3<br>2 - 5<br>3 - 5<br>5 - 10 | Ditto |
| 5 | Thar Souk | Syncline | 597500 to 602500 | 449500 to 452000 | 480-550 | Quaternary<br>Miocene<br>(Sahelian) | Recent alluvium<br>Conglomerates | — | 2<br>3 | 150(each)<br>30 (each) | Ranges between<br>3 - 7<br>1 - 3 | Ditto |
| | Hilly Water Potential Structures | | | | | | | | | | | |
| 6 | Teroual | Syncline | 511000 to 512500 | 451500 to 453000 | 400-430 | Upper Miocene<br>Oligocene | Conglomerates + Marl<br>Marly Sandy Limestone | 2- Springs<br>Flow Rate Ranges<br>between 20-70 m3/d | 3<br>1<br>1 | 30 (each)<br>125<br>150 | Ranges between<br>1 - 2<br>5 - 10<br>8 - 15 | Ditto |
| 7 | Ourtzarh | Syncline | 540000 to 542000 | 436200 to 438500 | 150-190 | Quaternary<br>Miocene (Tortonian) | Recent Alluvium<br>Karsts & Fissured<br>Conglomerates | 5- Springs<br>Flow Rate Ranges<br>Between 1 - 7 m3/d | 2 | 300 (each) | Ranges between<br>5 - 12 | Ditto |

## Table 2.1.5 Hydrogeological Characteristics of Groundater Potential Structures (2/2)

| Geological Structures | | | Structure Coordinates | | | Water Bearing Formations | | Water Potentiality (Estimated) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Structure's | Ground Water Exploration | | | |
| No. | Location | Type | X | Y | Z | Epoch or Stage | Lithology | Springs | No. of Wells Proposed | Depth (m) | Estimated Productivity (l/s) | Water Quality |
| 8 | Ain Saddine (Rdat Valley) | Syncline | 486500 to 489000 | 449000 to 453000 | 110-200 | Quaternary<br>Pliocene<br>Miocene | Recent Alluvium<br>Conglomerates + Marl<br>Conglomerates + Marl | 1- Spring<br>Flow Rate<br>90m3/d | 3<br>1<br>1 | 30(each)<br>100<br>150 | Ranges between<br>1 - 2<br>2 - 5<br>3 - 7 | Chemically Acceptable |
| 9 | Taounate Sra Valley | Syncline | 571000 to 573000 | 440000 to 443000 | 300-330 | Quaternary<br>Miocene-Tortonian | Recent Alluvium<br>Karsts & fissured conglomerates | — | 3<br>1 | 30(each)<br>250 | Ranges between<br>5 - 15<br>15 - 20 | Ditto |
| 10 | Tissa Lebene Valley | Syncline | 569000 to 547000 | 410000 to 412000 | 190-200 | Quaternary<br>Oligocene | Conglomerates<br>Marly Sandy Limestone | — | 3<br>1<br>1 | 30(each)<br>75<br>100 | Ranges between<br>3 - 5<br>4 - 7<br>5 - 10 | Ditto |
| Flat Plain water Potenial Structure | | | | | | | | | | | | |
| 11 | Jorf El Malha | Syncline | 488500 to 491000 | 429500 to 431500 | 40-70 | Quaternary<br>Miocene-Tortonian | Recent Alluvium<br>Conglomerates | — | 3<br>1 | 30(each)<br>125 | Ranges between<br>5 - 10<br>7 - 12 | Ditto |
| 12 | Ain Defali | Syncline | 484500 to 487500 | 443200 to 446500 | 90-130 | Quaternary<br>Miocene | Recent Alluvium<br>Conglomerates | — | 3<br>1 | 30(each)<br>125 | Ranges between<br>3 - 5<br>5-10 | Ditto |
| 13 | Had Kourt | Depression | 468700 to 471300 | 444000 to 447500 | 130-150 | Quaternary<br>Miocene | Recent Alluvium<br>Conglomerates | — | 3<br>1 | 30(each)<br>125 | Ranges between<br>1 - 3<br>3 - 5 | Ditto |

Notes : - The numbers and depths of the wells suggested for each structure are based on the hydrogeological field reconnaissance, and are subject to modification in accordance with the geophysical prosoection and logging.
- The estimated productivity of each well is estimated based on the lithological composition of the formations to be penetrated.

## Table 2.2.6 Population Projections in the Study Area (1/3)

| Province | Circle | Rural Commue | | Type | Population 1994 | | Percent | Years | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | As of 1986 | Present | | Previous | Present | Increase | 2000 | 2005 | 2010 |
| S. Kacem | Ouezzane | Teroual | Teroual | Rural | | 11740 | 0.7 | 12242 | 12676 | 13126 |
| | | | Zghira | Rural | 27 488 | 15748 | 0.7 | 16421 | 17004 | 17607 |
| | | Aïn Dorij | Aïn Dorij | Urban | | 1258 | 3.6 | 1312 | 1358 | 1407 |
| | | | Lanjaara | Rural | 479 | 14479 | 0.7 | 15098 | 15634 | 16189 |
| | | S.Bousber | Sidi Bousber | Rural | | 11023 | 0.7 | 11494 | 11902 | 12325 |
| | | | S. Aed Cherif | Rural | 21 271 | 10248 | 0.7 | 10686 | 11065 | 11458 |
| | | S.Redouane | S. Redouane | Rural | | 19986 | 0.7 | 20840 | 21580 | 22346 |
| | | | Bni Quolla | Rural | 37 785 | 17799 | 0.7 | 18560 | 19219 | 19901 |
| | | Mzefroune | Mzefroune | Rural | | 8695 | 0.7 | 9067 | 9388 | 9722 |
| | | | Masmouda | Rural | 26 793 | 18198 | 0.7 | 18976 | 19649 | 20347 |
| | | | Ounnana | Rural | 12248 | 12248 | 0.7 | 12772 | 13225 | 13694 |
| | | Ouezzane | Ouezzane | Urban | 52168 | 52168 | 3.6 | 54398 | 56329 | 58328 |
| | Total of Circle | | | | | 193590 | | 201866 | 209029.3 | 216450 |
| | Had Kourt | Had kourt | Had Kourt | Urban | | 4296 | 3.6 | 4480 | 4639 | 4803 |
| | | | My.A.kader | Rural | | 8835 | 0.7 | 9213 | 9540 | 9878 |
| | | | Sidi Azzouz | Rural | 28 927 | 15796 | 0.7 | 16471 | 17056 | 17661 |
| | | Aïn Dfali | Aïn Dfali | Rural | | 23930 | 0.7 | 24953 | 25838 | 26756 |
| | | | Bni Oual | Rural | 33 944 | 10014 | 0.7 | 10442 | 10813 | 11196 |
| | | S. A. Al Hadi | S.A. Al Hadi | Rural | | 11491 | 0.7 | 11982 | 12407 | 12848 |
| | | | S.A.B.Aïssa | Rural | 20 739 | 9248 | 0.7 | 9643 | 9986 | 10340 |
| | | Khnichet | Khnichet | Urban | | 6031 | 3.6 | 6289 | 6512 | 6743 |
| | | | | Rural | | 13791 | 0.7 | 14380 | 14891 | 15419 |
| | | | Oulad Nouel | Rural | | 11512 | 0.7 | 12004 | 12430 | 12871 |
| | | | S.Med.Chelh | Rural | | 7527 | 0.7 | 7849 | 8127 | 8416 |
| | | | Taoughilt | Rural | 50 298 | 11437 | 0.7 | 11926 | 12349 | 12787 |
| | | Jorf El Melha | Jorf El Melha (M) | Urban | | 10187 | 3.6 | 10622 | 10999 | 11390 |
| | | | Lamrabich | Rural | 153 359 | 19453 | 0.7 | 20284 | 21004 | 21750 |
| | Total of Circle | | | | | 163548 | | 170538 | 176591 | 182858 |
| Total Province of Sidi Kacem | | | | | | 357138 | | 372404 | 385620 | 399308 |

## Table 2.2.6 Population Projections in the Study Area (2/3)

| Province | Circle | Rural Commue | | Type | Population 1994 | | Percent | Years | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Previous | Present | | Previous | Present | Increase | 2000 | 2005 | 2010 |
| Taounate | K.B. Med | Bouchabel | Bouchabel | Rural | | 15937 | 0.7 | 16618 | 17208 | 17819 |
| | | | Jbabra | Rural | 33 935 | 17998 | 0.7 | 18767 | 19433 | 20123 |
| | | Loulja | Loulja | Rural | | 15474 | 0.7 | 16135 | 16708 | 17301 |
| | | | Sidi Abel | Rural | 28 570 | 13096 | 0.7 | 13656 | 14140 | 14642 |
| | | K. Ba Med. | K.Ba Med | Urban | | 13271 | 3.6 | 13838 | 14329 | 14838 |
| | | | My.A. Karim | Rural | | 8604 | 0.7 | 8972 | 9290 | 9620 |
| | | | Bni Snous | Rural | 30 913 | 9038 | 0.7 | 9424 | 9759 | 10105 |
| | | My. Bouchta | My. Bouchta | Rural | 17 235 | 17235 | 0.7 | 17972 | 18610 | 19270 |
| | | Ghouazi | Ghouazi | Rural | 18 876 | 18876 | 0.7 | 19683 | 20381 | 21105 |
| | | Mekansa | Mekansa | Rural | 21 330 | 21330 | 0.7 | 22242 | 23031 | 23849 |
| | Total of Circle | | | | | 150859 | | 157307 | 162889 | 168676.9 |
| | Taounate | A. Mediouna | A. Mediouna | Rural | 16 693 | 16693 | 0.7 | 17406 | 18024 | 18664 |
| | | Beni Oulid | Beni Oulid | Rural | 11 809 | 11809 | 0.7 | 12314 | 12751 | 13203 |
| | | B.O. Tafraout | B.O.Tafraout | Rural | 8 952 | 8952 | 0.7 | 9335 | 9666 | 10009 |
| | | Bouadel | Bouadel | Rural | 13 393 | 1393 | 0.7 | 1453 | 1504 | 1557 |
| | | Bouhouda | Bouhouda | Rural | 23 257 | 23257 | 0.7 | 24251 | 25112 | 26003 |
| | | Fennassa | Fennassa | Rural | 12 546 | 12546 | 0.7 | 13082 | 13547 | 14027 |
| | | Zrizar | Zrizar | Rural | | 7666 | 0.7 | 7994 | 8277 | 8571 |
| | | | Khlalfa | Rural | 18 549 | 10883 | 0.7 | 11348 | 11751 | 12168 |
| | | Dhar Souk | Dhar Souk | Urban | | 3311 | 3.6 | 3453 | 3575 | 3702 |
| | | | Tamedit | Rural | 25 879 | 22568 | 0.7 | 23533 | 24368 | 25233 |
| | | Taounate | Taounate | Urban | | 24378 | 3.6 | 25420 | 26322 | 27256 |
| | | | Rghoua | Rural | | 5528 | 0.7 | 5764 | 5969 | 6181 |
| | | | Merzaoua | Rural | 39 373 | 9467 | 0.7 | 9872 | 10222 | 10585 |
| | Total of Circle | | | | | 158451 | | 165225 | 171088 | 177159 |
| | Tissa | Aïn Aïcha | Aïn Aïcha | Rural | | 20640 | 0.7 | 21522 | 22286 | 23077 |
| | | | Aïn Maatouf | Rural | 31 690 | 17050 | 0.7 | 17779 | 18410 | 19063 |
| | | Aïn Legdah | Aïn Legdah | Rural | 12 498 | 12498 | 0.7 | 13032 | 13495 | 13974 |
| | | Bouarouss | Bouarouss | Rural | | 17975 | 0.7 | 18743 | 19409 | 20097 |
| | | | O.Daoud | Rural | 29 982 | 12007 | 0.7 | 12520 | 12965 | 13425 |
| | | Ras el Ouad | Ras el Oued | Rural | 16 280 | 16280 | 0.7 | 16976 | 17578 | 18202 |
| | | Tissa | Tissa | Urban | | 7059 | 3.6 | 7361 | 7622 | 7893 |
| | | | S.B.Lahcen | Rural | 25 523 | 18464 | 0.7 | 19253 | 19937 | 20644 |
| | | O.Bouabane | O.Bouabane | Rural | | 10855 | 0.7 | 11319 | 11721 | 12137 |
| | | | Messasa | Rural | 19 907 | 9052 | 0.7 | 9439 | 9774 | 10121 |
| | | Oulad Jmaa | Oulad Jmaa | Rural | | 9818 | 0.7 | 10238 | 10601 | 10977 |
| | | | Bsabsa | Rural | 17 745 | 7927 | 0.7 | 8266 | 8559 | 8863 |
| | Total of Circle | | | | | 159625 | | 166447.675 | 172357 | 178473 |

## Table 2.2.6 Population Projections in the Study Area (3/3)

| Province | Circle | Rural Commue | | Type | Population 1994 | | Percent | Years | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | As of 1986 | Present | | Previous | Present | Increase | 2000 | 2005 | 2010 |
| Taounate | Ghafsaï | Galaz | Galaz | Rural | 19 047 | 19047 | 0.7 | 19861 | 20566 | 21296 |
| | | Kissane | Kissane | Rural | 14 280 | 14280 | 0.7 | 14890 | 15419 | 15966 |
| | | Ourtzagh | Ourtzagh | Rural | 15 226 | 15266 | 0.7 | 15918 | 16484 | 17069 |
| | | Ratba | Ratba | Rural | | 12742 | 0.7 | 13287 | 13758 | 14247 |
| | | | S.Lhaj Med. | Rural | 19 560 | 6818 | 0.7 | 7109 | 7362 | 7623 |
| | | Sidi Mokhfi | Sidi Mokhfi | Rural | | 7100 | 0.7 | 7403 | 7666 | 7938 |
| | | | Timezgana | Rural | 19 603 | 12503 | 0.7 | 13037 | 13500 | 13979 |
| | | Tafrant | Tafrant | Rural | 13 356 | 13356 | 0.7 | 13927 | 14421 | 14933 |
| | | Tabouda | Tabouda | Rural | 13 570 | 13570 | 0.7 | 14150 | 14652 | 15172 |
| | | Ghafsaï | Ghafsaï | Urban | | 4255 | 3.6 | 4437 | 4594 | 4757 |
| | | | Oudka | Rural | | 7447 | 0.7 | 7765 | 8041 | 8326 |
| | | | S.Y.B.Zeroual | Rural | | 12750 | 0.7 | 13295 | 13767 | 14255 |
| | | | El Bibane | Rural | 30 725 | 6273 | 0.7 | 6541 | 6773 | 7014 |
| | Total of Cercle | | | | | 145407 | | 151620 | 157003 | 162575 |
| Total Province of Taounate | | | | | | 614342 | | 640600 | 663337 | 686879 |
| Taza | Taïnaste | Msila | Msila | Rural | | 11161 | 0.7 | 11638 | 12051 | 12479 |
| | | | Bragha | Rural | 20 924 | 9763 | 0.7 | 10180 | 10542 | 10916 |
| | | Taïnaste | Taïnaste | Urban | | 2074 | 3.6 | 2163 | 2239 | 2319 |
| | | | Taïnaste | Rural | | 8658 | 0.7 | 9028 | 9348 | 9680 |
| | | | El Gouzate | Rural | 19 724 | 8992 | 0.7 | 9376 | 9709 | 10054 |
| | | Beni Ftah | Beni Ftah | Rural | 14 246 | 14246 | 0.7 | 14855 | 15382 | 15928 |
| | | Kaf El Ghar | Kaf el Ghar | Rural | 11 229 | 11229 | 0.7 | 11709 | 12125 | 12555 |
| | | Taïfa | Taïfa | Rural | 11 013 | 11013 | 0.7 | 11484 | 11891 | 12313 |
| | | Traïba | Traïba | Rural | 10 034 | 10034 | 0.7 | 10463 | 10834 | 11219 |
| | Total of Circle | | | | | 87170 | | 90896 | 94121 | 97463 |
| | Taza | Beni Lent | Beni Lent | Rural | | 15033 | 0.7 | 15676 | 16232 | 16808 |
| | | | Oulad Chrif | Rural | | 11088 | 0.7 | 11562 | 11972 | 12397 |
| | Total of Circle | | | | | 26121 | | 27238 | 28204 | 29205 |
| | O. Amlil | | Oulad Zbaïr | Rural | | 15788 | 0.7 | 16463 | 17047 | 17652 |
| | | Bni Frassen | Bni Frassen | Rural | | 30683 | 0.7 | 31994 | 33130 | 34306 |
| | | | R.El Fouki | Rural | 40 401 | 9718 | 0.7 | 10133 | 10493 | 10865 |
| | Total of Circle | | | | | 56189 | | 58590 | 60670 | 62823 |
| Total Province of Taza | | | | | | 169480 | | 176724 | 182995 | 189491 |
| Grand Total for the Study Area | | | | | | 171474 | | 1189728 | 182995 | 189491 |

## Table 2.3.1 MEDIUM, SMALL AND HILL DAMS CONSTURCTED

| Province | Name of Dam | Scale | Coordinates (km) X | Y | Catchment Area (km2) | Storage (1,000 m3) |
|---|---|---|---|---|---|---|
| Taounate | Sahela | Medium | 566.850 | 441.250 | 120.00 | 62,000 |
| Taounate | Essaf | Small | 546.900 | 429.550 | 5.57 | 1,000 |
| Taounate | Jorf El Ghrab | Small | 534.800 | 423.950 | 1.70 | 900 |
| Al Hoceima | Oued Mobrouk | Hill | 609.546 | 470.334 | 1.40 | 170 |
| Taounate | Ain Guettra | Hill | 557.150 | 431.400 | 0.25 | 20 |
| Taounate | Ank Jmal | Hill | 541.900 | 430.350 | 1.70 | 32 |
| Taounate | Bab Boughazi | Hill | 554.650 | 430.630 | 0.29 | 20 |
| Taounate | Chtioui | Hill | 551.000 | 430.000 | 0.62 | 58 |
| Taounate | Douar Lakhazayne | Hill | 554.500 | 430.250 | 0.28 | 25 |
| Taounate | Douar Trifa | Hill | 549.950 | 430.100 | 0.95 | 80 |
| Taounate | El Khmiss Zrayzar | Hill | 572.100 | 443.600 | 0.90 | 43 |
| Taounate | Mahadama | Hill | 524.850 | 436.250 | 3.34 | 75 |
| Taounate | Ouldiat El Hafa 1 | Hill | 527.100 | 432.450 | 0.45 | 40 |
| Taounate | Ouled Boumaiza | Hill | 538.770 | 429.200 | 1.65 | 200 |
| Taounate | Sahelomar | Hill | 574.750 | 428.805 | 0.87 | 125 |
| Taounate | Si El Makhfi | Hill | 556.250 | 445.300 | 1.10 | 80 |
| Taounate | Sidi Moussa | Hill | 562.650 | 425.750 | 0.35 | 35 |

Source : AH

## Table 2.3.2 Present Surface Water Resource at Gauging Station

| River System | Gauging Station | Catchment Area (km2) | Average Discharge (m3/sec) | 95% Dependable Discharge (m3/sec) |
|---|---|---|---|---|
| Sebou | Dar El Arsa | 7620 | 24.43 | 5.86 |
| | Azib Soltane | 16450 | 51.59 | 10.92 |
| | Bel Ksiri | 25980 | 129.52 | 13.02 |
| Ouergha | Bab Ouender | 1756 | 17.76 | 0.86 |
| | Pont du Sker | 486 | 9.26 | 0.16 |
| | Ain Aicha | 2460 | 32.88 | 1.06 |
| | Galez | 500 | 10.53 | 0.03 |
| | Rhafsai | 777 | 12.46 | 0.08 |
| | Ourtzagh | 4392 | 55.90 | 1.03 |
| | Tabouda | 861 | 15.99 | 0.07 |
| | Tafrant | 953 | 16.61 | 0.06 |
| | M'Jaara | 6190 | 81.99 | 0.75 |
| Lebene | Tissa | 792 | 6.01 | 0.03 |
| Inaouen | Bab Merzouka | 1500 | 6.84 | 0.11 |
| | El Kouchat | 2570 | 13.17 | 0.34 |
| Rdat | Had Kourt | 673 | 2.74 | 0.00 |

**Table 2.3.3 Existing and Proposed Dams in the SBO Master Plan**

| River System | Name of Dam | Effective Storage (million $m^3$) | Remarks |
|---|---|---|---|
| Upper Sebou | Foum Kheng | 39.0 | |
| | M'Dez | 557.5 | |
| | Ain Timedrine | 2.8 | |
| | Ait Youb / Allal Fassi | 33.8 | Existing (1990) |
| Inaouen | Touahar | 60.0 | |
| | Idriss Ier | 1,100.0 | Existing (1973) |
| Lebene | Sidi Abbou | 60.6 | |
| Middle / Lower Sebou | Sidi Echahed | 106.6 | Under Construction |
| | Mechra El Hajra | - | (*) |
| | Lalla Aicha | - | |
| Ouergha | Asfalou | 88.0 | |
| | Rhafsai | 220.0 | |
| | Tafrant | 220.0 | |
| | Bab Ouender | 300.0 | |
| | Al Wahda | 3,000.0 | Under Construction |
| | Koudiat Bourna | - | (*) |
| Beht | Oujet Es Soltane | 175.3 | |
| | El Kansera | 266.6 | Existing (1935) |

Note : (*) - Intake dam for interbasin diversion

Source : The Integrated Master Plan on Water Resource Development in the Sebou, Bou Regreg and Oum Er Rbia Basins, 1992, AH

## Table 2.3.6 IMPLEMENTATION PROGRAM OF MEDIUM AND SMALL DAMS

Medium Scale Dam (1995 - 1999)

| Province | Name of Dam | Coordinates (km) X | Y | Catchment Area (km2) | Storage (1000 m3) | Construction Begining (year) | Period (month) |
|---|---|---|---|---|---|---|---|
| Taounate | Bouhouda | 576.450 | 445.850 | 478 | 50,000 | 1995 | 30 |
| Taounate | Tahar Souk | 602.950 | 452.650 | 468 | 20,000 | 1996 | 24 |
| Taounate | Aoulai | 542.150 | 467.850 | 490 | 40,000 | 1996 | 27 |
| Taounate | Ain Abdoun | 590.550 | 442.500 | 58 | 10,000 | 1997 | 36 |
| Taounate | Pont Sker | 572.800 | 441.900 | 540 | 41,000 | 1998 | 12 |
| Taounate | Zrizer | 571.250 | 444.200 | 26 | 6,000 | 1998 | 18 |
| Taounate | Sidi Mokfi | 558.450 | 448.300 | 378 | 26,000 | 1999 | 30 |

Small Scale Dam (1996 - 2001)

| Province | Name of Dam | Coordinates (km) X | Y | Catchment Area (km2) | Storage (1000 m3) | Construction Begining (year) | Period (month) |
|---|---|---|---|---|---|---|---|
| Chefchaouen | Douahar | 506.000 | 466.800 | 4.3 | 1,060 | 1996 | 12 |
| Taounate | Gharbia | 552.750 | 492.130 | 5.2 | 750 | 1996 | 18 |
| Chefchaouen | S. Abdessalem | 517.000 | 471.500 | 7.6 | 1,770 | 1996 | 18 |
| Al Hoceima | Mrint | 575.500 | 476.200 | 34.5 | 5,000 | 1997 | 18 |
| Taounate | Bousfoul | 554.000 | 450.150 | 5.3 | 2,000 | 1997 | 15 |
| Taounate | Addad | 539.810 | 440.900 | 16.6 | 887 | 1997 | 15 |
| Chefchaouen | Koucha | 506.000 | 465.450 | 6.6 | 1,347 | 1998 | 18 |
| Al Hoceima | Bouhout | 608.200 | 470.200 | 3.5 | 780 | 1998 | 18 |
| Chefchaouen | Mokrisset | 505.250 | 482.500 | 4.1 | 991 | 1998 | 12 |
| Taounate | Ain Daroua | 542.750 | 444.450 | 2.8 | 500 | 1999 | 15 |
| Taounate | D. Meckour | 572.600 | 447.400 | 2.3 | 500 | 1999 | 12 |
| Taounate | O. Merzaine | 568.300 | 447.775 | 2.9 | 930 | 1999 | 18 |
| Al Hoceima | Azila | 580.000 | 473.850 | 8.0 | 350 | 2000 | 18 |
| Chefchaouen | Kchachda | 507.500 | 468.600 | 19.5 | 5,210 | 2000 | 15 |
| Chefchaouen | Tillouane | 512.015 | 481.450 | 2.5 | 608 | 2000 | 24 |
| Taounate | K. Assassa | 555.400 | 444.600 | 2.7 | 570 | 2001 | 12 |
| Taounate | Gaadiine | 568.000 | 429.100 | 2.3 | 270 | 2001 | 12 |
| Taza | Amlilis | 624.700 | 465.700 | 8.4 | 1,600 | 2001 | 12 |

Source : AH

## Table 2.5.2 Existing Surface Water Supply Systems

| | Technical Specifications | Water Supply System | | |
|---|---|---|---|---|
| | | Ain Gdah | Mekansa | Karia Ba Moh. |
| 1 | **Establishment** | | | |
| | a. Construction | 1988 | 1987 | - |
| | b. Commencement of management by ONEP | 1991 | 1991 | 1985 |
| 2 | **Intake and Raw Water Transmission Main** | | | |
| | a. Water source | Inaouene river | Sebou river | Sebou river |
| | b. Pumps | | | |
| | Nos. of unit | 3 | 2 | 2 |
| | Flow rate ( m3/s ) | 0.040 | 0.028 | 0.035 |
| | Pump head ( m ) | 18.0 | 15.2 | 15.0 |
| | c. Transmission pipe | | | |
| | Diameter ( mm ) | - | - | 200 |
| | Pipe material | - | D.I.P | A.C. |
| | Length ( m ) | - | - | 360 |
| | Flow rate ( m3/s ) | - | - | 0.035 |
| 3 | **Treatment Plant** | | | |
| | a. Capacity | | | |
| | Daily Max. ( m3/d ) | 5.500 | 4.800 | 2.600 |
| | Average Daily ( in winter ) ( m3/d ) | 800 | 2.200 | 1.300 |
| | Average Daily ( in summer ) ( m3/d ) | 2.000 | - | - |
| | Served population | - | 22.000 | - |
| | b. Number of unit | | | |
| | Receiving well | 1 | 1 | 1 |
| | Mixing basin | 1 | 1 | 1 |
| | Flocculation basin | 1 | 1 | 1 |
| | Sedimentation basin | 2 | 2 | 2 |
| | Filter | 4 | 4 | 4 |
| | Clear water basin | 1 | 1 | 1 |
| | c. Raw water quality | | | |
| | Turbidity: max (min) | > 1000 (10) | >1000 (15) | >1000 (15) |
| | pH: max (min) | 8.5 (7.5) | 8.5 (7.5) | 8.5 (7.5) |
| | Chloride iron: max (min) (mg/l) | 450 (65) | 7500 (78) | 13.500 (64) |
| | SS: max (min) (mg/l) | - | - | - |
| | Oxygen Demand: max (min) (mg/l) | - | 45 (0.72) | 50 (0.72) |
| 4 | **Treated Water Transmission Main** | - | - | - |
| | a. Pipe diameter ( mm ) | (T/P-R1) 300 | (T/P-R1) 200 | 200 |
| | | (R1-R2) 200 | (R1-R2) 200 | - |
| | b. Pipe material | S.P. DIP | S.P. DIP | S.P. DIP |
| | c. Pipe length ( m ) | (T/P-R1) 2.093 | (T/P-R1) 6.500 | 5.000 |
| | Pipe length ( m ) | (R1-Head) 6.879 | (R1-R2) 2.200 | 145 |
| | Pipe length ( m ) | (Head-R2) 4.176 | - | - |
| | d. Pumping head ( m ) | (T/P-R1) 239 | (T/P-R1) 238 | 170 |
| | Pumping head ( m ) | (Head-R2) 292 | (R1-R2) 200 | - |
| | | | | |
| 5 | **Reservoir** | | | |
| | Main reservoir | 2 | 2 | - |
| | Distribution reservoir | 27 | 23 | - |
| | Capacity (main) | 1.500 - 3.000 | 1.100 - 1.800 | - |
| | Capacity (secondary) | 30 - 200 | 30 - 450 | - |
| | Type | Circular, Semi-ground | | |
| 6 | **Distribution Facilities** | | | |
| | a. Public stand pipes | | | |
| | meter reading | 1 time / month | 1 time / month | 1 time / month |
| | b. Pipe material | | | |
| | Transmission main | S.P. D.I.P | S.P. D.I.P | S.P. D.I.P |
| | Distribution main | A.C. | A.C. | A.C. |
| | Connection pipe | G.S.P. PVC | G.S.P. PVC | G.S.P. PVC |

Source: ONEP

## Table 2.5.5 Water Consumption for 1990 Projected by DRPE

| Province | Homog. Zone No. | Water Consumed | | | | | | | | | | | Level Satisfaction % of localities | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Surface Water | | Groundwater | | Available on Site | | | Import | Export | Ttl. Avail. Water | | | | | |
| | | m3/y | m3/e.w.s. | m3/y | m3/e.w.s. | m3/y | l/c/d(srvd) | l/c/d(totl) | m3/y | m3/y | m3/y | l/c/d | bad | Insuffi. | good | sat. |
| **Sidi Kacem** | 5 | 132 | 148 | 644,133 | 955 | 644,266 | 37 | 31 | 39,396 | 20,282 | 663,380 | 32 | 1 | 42 | 58 | 0 |
| | 6 | 0 | 0 | 723,187 | 397 | 723,187 | 29 | 25 | 134,410 | 79,424 | 778,173 | 27 | 9 | 39 | 52 | 0 |
| | 7 | 481,850 | 46,758 | 1,681,122 | 541 | 2,162,972 | 42 | 26 | 784,265 | 742,854 | 2,204,383 | 27 | 10 | 62 | 26 | 2 |
| | Total | 481,982 | 46,906 | 3,048,442 | 1,893 | 3,530,425 | (38) | (27) | 958,071 | 842,560 | 3,645,936 | (28) | 20 | 143 | 136 | 2 |
| **Taounate** | 6 | 0 | 0 | 3,467,337 | 397 | 3,467,337 | 29 | 25 | 644,435 | 380,800 | 3,730,972 | 27 | 9 | 39 | 52 | 0 |
| | 7 | 601,983 | 46,758 | 2,100,250 | 541 | 2,702,232 | 42 | 26 | 979,793 | 928,058 | 2,753,967 | 27 | 10 | 62 | 26 | 2 |
| | Total | 601,983 | 46,758 | 5,567,587 | 938 | 6,169,569 | (34) | (26) | 1,624,228 | 1,308,858 | 6,484,939 | (27) | 9 | 49 | 41 | 1 |
| **Taza** | 7 | 632,237 | 46,758 | 2,205,804 | 541 | 2,838,041 | 42 | 26 | 1,029,035 | 974,700 | 2,892,375 | 27 | 10 | 62 | 26 | 2 |
| | Total | 632,237 | 46,758 | 2,205,804 | 541 | 2,838,041 | (42) | (26) | 1,029,035 | 974,700 | 2,892,375 | (27) | 10 | 62 | 26 | 2 |

Source: The Study on The National Master Plan of Rural Population Potable Water Supply, Mission I, Volume II, March, 1992

Note: e.w.s: equipped water source

s.a.: seasonally acceptable

( ): average

DRPE: Department of Research of Potable Water

Table 2.5.6 Water Supply Facilities of Rural Centers Controlled by ONEP as of July, 1995

| | Center | Water Source | Population | House Connection | Popu. by H.C. 8 pers/HC (6.3 pers/HC) | Rate of Popu. by H.C. (%) | Available Flow (l/s) | Average Water Production (l/s) | Water Production Facilities | Storage Facilities |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Taounate | G.W | 24,378 | 3,591 | 28,728 (22,623) | 2) 117.8% (92.8%) | 50 | 26.00 | 4-P.S. on wells & 2-B.P. | 1-RSV 750m3 |
| 2 | Tissa | G.W | 7,059 | 778 | 6,224 (4,901) | 88.2% (69.4%) | 15 | 6.59 | 1-P.S. on a well, 2-P.S. on wells & 2-B.P. | 1-RSV 150m3<br>1-RSV 450m3, 1-HT 100m3 |
| 3 | Karia Ba Mohamed | S.W of Sebou river | 13,271 | 1,263 | 10,104 (7,957) | 76.1% (60.0%) | 44 | 18.90 | 1-T/P & 1-B.P., 1-P.S on a well | 1-RSV 1000m3<br>1-RSV 500m3 |
| 4 | Mly Bouchta | G.W | 3,143 | 32 | 256 (202) | 8.1% (6.4%) | 1 | 0.20 | 1-spring | 1-RSV 80m3 |
| 5 | Ain Gdah | S.W of Sebou river | 32,407 | 375 | 3,000 (2,363) | 9.3% (7.3%) | 65 | 13.38 | 1-T/P and 2-B.P. | 1-RSV 3000m3, 1-RSV 1500m3<br>57 SRSV 6,825m3 |
| 6 | M'Kansa | S.W of Sebou river | 21,331 | 261 | 2,088 (1,644) | 9.8% (7.7%) | 56 | 4.74 | 1-T/P & 2-B.P. | 1-RSV 1800m3, 1-RSV1100m3<br>21 SRSV 2,230m3 |
| 7 | Ain Aicha | G.W | 4,000 | 202 | 1,616 (1,273) | 40.4% (31.8%) | 3 | 0.65 | 1-P.S. on a well | 1-RSV 50m3 |
| 8 | Rhafsai | G.W | 4,255 | 737 | 5,896 (4,643) | 1) 138.6% 1) (109.1%) | 9 | 4.17 | 1-P.S. on a well & 1-B.P.,1-spring | 1-RSV 200m3, 1-RSV 80m3<br>1-RSV 60m3 |
| 9 | Ourtzagh | G.W | 1,660 | 238 | 1,904 (1,499) | 2) 114.7% (90.3%) | 3 | 2.46 | 1-T.P. & 1-B.P. | 1-RSV 100m3 |
| | **Total** | | 111,504 | 7,477 | 59,816 | | 246 | 77.09 | | 19,925 m3 |

Source: ONEP Taounate

Note: P.S. = Pumping Station
B.P. = Booster Pump
T/P = Treatment Plant
G.W = Groundwater
8 person/house connection = Established by National Master Plan
6.3 person/house connection = Established by CERED

RSV. = Reservoir
SRSV. = Secondary Reservoir
H.C. = House Connection
S.W = Surface Water
1) = Person/House Connection may be less than 6
2) = Person/House Connection may be less than 7

## Table 2.5.7 Water Production and Consumption in Taounate Province, 1994

| | Water Supply Center | Population | House Connect. | Water Produc. (m3) | Water Distribu. (m3) | Water Consum. (m3) | Relative UW Consum. (l/c/d) | Revenue Ratio (%) | Unaccounted for Water (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Taounate | 24,379 | 3,297 | 677,686 | 654,543 | 531,874 | 59.8 | 78.5 | 21.5 |
| 2 | Karia Ba Mohamed | 13,270 | 1,234 | 489,936 | 450,606 | 307,308 | 63.4 | 62.7 | 37.3 |
| 3 | Mly Bouchta | 3,140 | 32 | 9,934 | 9,132 | 6,251 | 5.5 | 62.9 | 37.1 |
| 4 | M'kansa | 21,331 | 251 | 143,478 | 137,652 | 92,997 | 11.9 | 64.8 | 35.2 |
| 5 | Ain Gdah | 29,478 | 368 | 335,065 | 323,788 | 151,755 | 14.1 | 45.3 | 54.7 |
| 6 | Tissa | 7,059 | 680 | 164,252 | 156,910 | 112,630 | 43.7 | 68.6 | 31.4 |
| 7 | Rhafsai | 4,255 | 737 | 87,140 | 82,784 | 54,363 | 35.0 | 62.4 | 37.6 |
| 8 | Ouartzagh | 2,638 | 234 | 27,934 | 26,538 | 13,064 | 13.6 | 46.8 | 53.2 |
| 9 | Ain Aicha | 4,000 | 193 | 8,500 | 8,076 | 5,060 | 3.5 | 59.5 | 40.5 |
| | Total | 109,550 | 7,026 | 1,943,925 | 1,850,029 | 1,275,302 | (Ave.)31.9 | (Ave.)65.6 | (Ave.)34.4 |

Source: ONEP Taounate
UW: Unit Water

## Table 2.5.8 Water Production and Consumption in Taounate Province ( January, February and March, 1995 )

| | Water Supply Center | Population | House Connect. | Water Produc. (m3) | Water Distribu. (m3) | Water Consum. (m3) | Relative UW Consum. (l/c/d) | Revenue Ratio (%) | Unaccounted for Water (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Taounate | 24,379 | 3,470 | 205,383 | 201,276 | 125,975 | 57.4 | 61.3 | 38.7 |
| 2 | Karia Ba Mohamed | 13,270 | 1,234 | 112,262 | 104,382 | 76,633 | 64.2 | 68.3 | 31.7 |
| 3 | Mly Bouchta | 3,140 | 32 | 1,820 | 1,583 | 1,460 | 5.2 | 80.2 | 19.8 |
| 4 | M'kansa | 21,331 | 251 | 27,907 | 25,100 | 18,598 | 9.7 | 66.6 | 33.4 |
| 5 | Ain Gdah | 29,478 | 368 | 74,192 | 70,721 | 29,204 | 11.0 | 39.4 | 60.6 |
| 6 | Tissa | 7,059 | 749 | 42,448 | 38,975 | 29,504 | 46.4 | 69.5 | 30.5 |
| 7 | Rhafsai | 4,255 | 737 | 10,884 | 10,367 | 7,680 | 20.1 | 70.6 | 29.4 |
| 8 | Ouartzagh | 2,638 | 234 | 11,197 | 10,636 | 5,143 | 21.7 | 45.9 | 54.1 |
| 9 | Ain Aicha | 4,000 | 193 | 4,116 | 3,650 | 2,419 | 6.7 | 58.8 | 41.2 |
| | Total | 109,550 | 7,268 | 490,209 | 466,690 | 296,616 | (Ave.) 30.1 | (Ave.) 60.5 | (Ave.) 39.5 |

Source: ONEP Taounate
UW: Unit Water

Table 2.5.10 Proposed and Ongoing Projects by ONEP in Taounate Province

| Rural Center | Project Description | Cost(DH) (x1,000) | Design Work | Constru. Period | Remarks |
|---|---|---|---|---|---|
| *M'kansa | Rehabilitation of water supply facilities and reinforcement of treatment capacity | 10,000 | completed | 12 months | Invitation for tender expected on July 17, 95 |
| *Karia Ba Mohamed | Double the capacity of water supply facilities up to 30 l/s | 30,000 | completed | 12 months | Invitation for tender expected on July 17, 95 |
| *My Bouchta | Construction of transmission line, extension of network to accommodate a flow rate of 10 l/s with reservoir | 18,500 | to be completed by August 95 | 12 months | Invitation for tender expected on August 17, 95 |
| *My Bouchta | Provision of facilities to the douars | 10,000 | to be completed by August 95 | 12 months | Invitation for tender expected on August 17, 95 |
| *Ain Aicha | Equipping a well for a flow rate of 10 l/s and extension of network including a reservoir | 14,000 | to be completed by July 95 | 8 months | Invitation for tender expected on July 17, 95 |
| *Ain Mediouna | Exploitation of a well for a flow rate of 10 l/s and extension of the network, including the construction of a reservoir | 14,000 | to be completed by July 95 | 8 months | Invitation for tender expected on July 17, 95 |
| *Rhafsai | Transmission line, extension of network, construction of a reservoir for a flow rate of 5 l/s | 10,500 | to be completed by July 95 | 8 months | Invitation for tender expected on July 17, 95 |
| *Taounate | Provision of water production and distribution facilities | 77,000<br>10,000 | completed<br>completed | 12 months<br>12 months | Work on production facilities started on July 7, 95<br>Work on production facilities started on July 24, 95 |
| Laghouazi | Equipping a well for a flow rate of 2 l/s, distribution network and reservoir | 6,000 | to be completed by August 95 | 8 months | Selection of water source is under way |
| *Ourtzagh | Rehabilitation of the force main and the distribution network | 2,700 | to be completed by August 95 | 8 months | Invitation for tender for the rehabilitation of the distribution facilities July 17,95 |
| Tafrant | Provision of water production and distribution facilities | 12,000 | to be completed by August 95 | 8 months | Selection of the water source is under way and invitation for tender for the distribution facilities on July 17, 95 |
| Bouchabel | Supply of Bouchabel rural center and 18 douars from the proposed transmission line of Mly Bouchta | 6,000 | to be completed by July 95 | 12 months | Design work under preparation by the Regional Direction of ONEP |
| Tahar-souk | Equipping a spring, extension of network and rehabilitation of the reservoir | 3,000 | to be completed by July 95 | 12 months | design work under preparation by ONEP |
| Sidi M'hamed Bel Laheen | Supply of the rural center and 15 douars from the Ain Gdah system | 5,700 | to be completed by July 95 | 12 months | Construction started in June 95 |
| Bni Souss | Supply of the rural center and 15 douars from the M'kansa system | 2,000 | to be completed by July 95 | 12 months | Construction started in June 95 |

Source: ONEP Taounate Provincial Office

* : Existing ONEP system

## Table 2.6.1 Drinking Water Quality Standard

| AGENCY/COUNTRY | WHO* Recomm. Standards Maximum | MOROCCO Allowable value | | MOROCCO SUITABLE QUALITY FOR LIVESTOCK | | | |
|---|---|---|---|---|---|---|---|
| | | Recomm. | Acceptable | Good | Passable | Average | Low |
| PARAMETERS | | | | | | | |
| 1. Total hardness(meg/l) | <10 | | | | | | |
| 1 meg/l = 50 mg/l as CaCO3 | | | | | | | |
| 2. Turbidity (NTU) | 5 | 1 | 5 | | | | |
| 3. Color (platinum-cobalt scale) | 15 | 5 | 20 | | | | |
| 4. Iron, as Fe (mg/l) | 0.3 | 0.3 | | | | | |
| 5. Manganese, as Mn (mg/l) | 0.1 | | | | | | |
| 6. pH | 6.5 ~ 8.5 | 6.5 ~ 8.5 | 9.2 (min.6.0) | | | | |
| 7. Nitrate, as N03 (mg/l) | 45 | | 50 | | | | |
| 8. Sulfate, as SO4 (mg/l) | 400 | 200 | | 0 ~ 150 | 150 ~ 290 | 290 ~580 | 580 ~1150 |
| 9. Flouoride, as F (mg/l) | 1.5 | 0.7 | 1.5 | | | | |
| 10. Arsenic, as As (mg/l) | | 0.05 | | | | | |
| 11. Magnesium, as Mg (mg/l) | 150 | 100 | | 0 ~ 30 | 30 ~60 | 60 ~120 | > 120 |
| 12. Salinity | | | | | | | |
| a. Dry residual (mg/l) at 180 C | | 1000 | 2000 | 0 ~ 500 | 500 ~1000 | 1000 ~2000 | 2000 ~4000 |
| b. Electrical Conductivity (µS/cm at 20°C) | | 1300 | 2700 | 0 ~ 800 | 800 ~1600 | 1600 ~3200 | 3200 ~6400 |
| c. Chloride (mg/l) | 250 | 300 | 750 | 0 ~ 180 | 180 ~ 360 | 360 ~710 | 710 ~1420 |
| 13. Total Coliforms (no./100 ml) | | | | | | | |
| a. Piped water supply | 0 | 0 | 0 | | | | |
| b. Disinfected water at entrance of distribution system | 0 | 0 | 3 (no two consecutive samples at same point) | | | | |

Source: National Master Plan
Note: * World Health Organization

Table 2.6.2 Water Quality in Dughole (1/3)

| PROVINCE | COMMUNE | DOUAR | CONDUCTIVITY µS/cm | QUALITY CLASS* |
|---|---|---|---|---|
| TAZA | BENI FRASEN | OULAD YACOUB | | |
| | B.MARZOUKA | AL HADA | | |
| | BENI LENT | OULAD HAJOUN | | |
| | | DHAR DREJRA | | |
| | GUELDAMANE | NAKHLA | 1680 | AVERAGE |
| | | S.MAM MEFTAH | | |
| | OULAD CHRIF | CENTRE | | |
| | | S BOUYADOUR | | |
| | OULAD ZBAIR | TAJAYALT | SALTY | SALINE |
| | RHIATA RHAR | KASBAT MGARA | | |
| | | BAB LAGHNEM | SALTY | SALINE |
| | TAIFA | KT .BENI | SALTY | SALINE |
| | | OUARIAGHEL | | |
| | TAZA | DPTP | | |
| | MEKNASSA CH | BENI HAITAM | | |
| | B.MARZOUKA | STA. HYDROLO. | | |
| | | ASDOUR | | |
| | SMIA | BAB TAZA | | |
| | OULAD CHRIF | BAB RAMLA | 1076 | PASSABLE |
| | OULAD CHRIF | BAB RAMLA | 970 | PASSABLE |
| | BNI LENT | BNI LENT | 1011 | PASSABLE |
| | BNI LENT | BNI LENT | 1131 | PASSABLE |
| | BOUCHEFAA | BOUCHEFAA | 430 | GOOD |
| | BNI FRASEN | BNI FRASEN | 997 | PASSABLE |
| | RBAA FOUKIA | RBAA FOUKIA | 777 | GOOD |
| | BENI FETAH | BNI FTAH | 2300 | AVERAGE |
| TAOUNATE | TAOUNATE | MEZRAOUA | 611 | GOOD |
| | | SOUFLA | | |
| | | HJAR | 9070 | SALINE |
| | | MAABID | | |
| | | MAABID | | |
| | | IMRAGHDEN | BAD | SALINE |
| | | IMRAGHDEN | 960 | PASSABLE |
| | BENI OULID | BENI OULID | 674 | GOOD |
| | GHAFSAI | AIN BARDA | | |
| | AIN AICHA | OD BOUTIA | 298 | GOOD |
| | | OULED | | |
| | | BOUSLTANE | | |
| | | M'HAMDA | 593 | GOOD |
| | | KALLALINE | | |
| | OD. HAMMOU | FENNASA | 263 | GOOD |
| | 3eme PONT | LAAZAIB | 9990 | SALINE |
| | BSABSA 2KT | KBIB | 320 | GOOD |

* based on conductivity (µS/cm) as below

| 0 -800 | 800 - 1600 | 1600 - 3200 | 3200 - 6400 | > 6400 |
|---|---|---|---|---|
| GOOD | PASSABLE | AVERAGE | LOW | SALINE |

Source: National Master Plan

## Table 2.6.2 Water Quality in Dughole (2/3)

| PROVINCE | COMMUNE | DOUAR | CONDUCTIVITY µS/cm | QUALITY CLASS* |
|---|---|---|---|---|
| TAOUNATE | | CHTUYNE | | |
| | | EL ABBADMA | 4660 | LOW |
| | | BSABSA | 4230 | LOW |
| | | OULAD ALI | | |
| | | SABBAB | 540 | GOOD |
| | | HAJRAT | 13350 | SALINE |
| | | LHAYAR | | |
| | | OULAD | 1490 | PASSABLE |
| | | ABDESSLAM | | |
| | | BNI HMIED | | |
| | | Od MIMOUN | 640 | GOOD |
| | | OULAD BEN | 580 | GOOD |
| | | TALHA | | |
| | | KRADSA | 7790 | SALINE |
| | | RZINA | 1500 | PASSABLE |
| | | BNI OUKIL | 2660 | LOW |
| | | A.L'HAMRA | 710 | GOOD |
| | | KHANDEK | 1230 | PASSABLE |
| | | ISLAN | | |
| | | BOUCHAN | 640 | GOOD |
| | | KELAA | | |
| | | OD AZZAME | | |
| | | MZRAOUA | | |
| | | OULIA | 14800 | SALINE |
| | | L'HIOUAL | 2000 | AVERAGE |
| | | TIMZGANA | 1540 | PASSABLE |
| | | SI.MOKHFI | 2510 | AVERAGE |
| | | FENNASSA | 460 | GOOD |
| | | TAMSNIT | 990 | PASSABLE |
| | | AMEZRI | 2270 | AVERAGE |
| | | SIDI YAHYA | | |
| | | BOUTHAL | 3370 | LOW |
| | | LAKLAI | | |
| | BOUAROUS | OD.MESSAOUD | 714 | GOOD |
| | BOUCHABEL | OULAD ALLAL | | |
| | BSABSA | HOUARA | | |
| | | KERAIA | 2900 | AVERAGE |
| | OULJA | OD.BEN TAHAR | | |
| | OLD JEMAA | HAMZA | | |
| | OLD AYAD | LEMOUALDA | | |
| | OULJA | B.ZEKIENE | | |
| | SI.MHAMED | NOUAOURA | 8900 | AVERAGE |
| | B. LAHCEN | | | |

* based on conductivity (µS/cm) as below

| 0 - 800 | 800 - 1600 | 1600 - 3200 | 3200 - 6400 | > 6400 |
|---|---|---|---|---|
| GOOD | PASSABLE | AVERAGE | LOW | SALINE |

Source: National Master Plan

## Table 2.6.2 Water Quality in Dughole (3/3)

| PROVINCE | COMMUNE | DOUAR | CONDUCTIVITY µS/cm | QUALITY CLASS* |
|---|---|---|---|---|
| SIDI KACEM | SIDI MED | CHEF LIEU | | |
| | SIDI ABED | LAKRADSA 1 | 5900 | SALINE |
| | | LAKRADSA 2 | 1600 | PASSABLE |
| | JBABRA | OULAD BLIL | | |
| | GALAZ | ZAOUIA | | |
| | A. MAATOUF | OULAD KHRIF | | |
| | BOUCHABEL | OULAD BEN YOUSSEF | | |
| | A. MEDIOUNA | A. MEDIOUNA | 500 | GOOD |
| | FIFI | BEN YARZINE | | |

* based on conductivity (µS/cm) as below

| | | | | |
|---|---|---|---|---|
| 0 -800 | 800 - 1600 | 1600 - 3200 | 3200 - 6400 | > 6400 |
| GOOD | PASSABLE | AVERAGE | LOW | SALINE |

Source: National Master Plan

## Table 2.6.3 Classification of Provinces based on Number of Cases of Water Borne Diseases

| PROVINCES | CHOLERA (1) | | | TYPHOID | INFANT MORTALITY | MARK OUT OF 10 | MARK OUT OF 2 |
|---|---|---|---|---|---|---|---|
| | 1990 | 1993 | TOTAL | (2) | (3) | (4) | |
| 35 KENITRA | 2 | 1 | 3 | | | 6 | 1.2 |
| 05 AZILAL | 2 | | 2 | 2 | 2 | 6 | 1.2 |
| 39 KHENIFRA | | 2 | 2 | 1 | 1 | 6 | 1.2 |
| 71 TETOUAN | 2 | | 2 | 2 | 2 | 6 | 1.2 |
| 60 SIDI KACEM | 1 | 1 | 2 | 1 | 1 | 5 | 1 |
| 69 TAZA | 2 | | 2 | 1 | | 5 | 1 |
| 27 FES | 2 | | 2 | | | 4 | 0.8 |
| 37 KHEMISSET | | 2 | 2 | | | 4 | 0.8 |
| 47 MEKNES | 1 | 1 | 2 | | | 4 | 0.8 |
| 61 TANGER | 2 | 2 | | | 2 | 4 | 0.8 |
| 15 CHEFCHAOUEN | 1 | 1 | | 2 | | 4 | 0.8 |
| 33 IFRANE | 1 | 1 | 2 | | | 4 | 0.8 |
| 45 MARRAKECH | 1 | 1 | | 2 | | 4 | 0.8 |
| 65 TAOUNATE | 1 | 1 | | 2 | | 4 | 0.8 |
| 19 EL KELAA | 1 | 1 | 1 | | | 3 | 0.6 |
| 13 BOULMANE | | | 2 | 1 | | 3 | 0.6 |
| 07 BENI MELLAL | 1 | 1 | | | | 2 | 0.4 |
| 41 KHOURIBGA | 1 | 1 | | | | 2 | 0.4 |
| 55 OUJDA | 1 | 1 | | | | 2 | 0.4 |
| 59 SETTAT | 1 | 1 | | | | 2 | 0.4 |
| 21 ERRACHIDIA | | | | 2 | | 2 | 0.4 |
| 23 ESSAOUIRA | | | | 2 | | 2 | 0.4 |
| 51 OUARZAZATE | | | | 2 | | 2 | 0.4 |
| 67 TATA | | | | 2 | | 2 | 0.4 |
| BOUJDOUR | | | 2 | | | 2 | 0.4 |
| 03 AL HOCEIMA | | | | 1 | | 1 | 0.2 |
| 29 FIGUIG | | | | 1 | | 1 | 0.2 |
| 57 SAFI | | | 1 | | | 1 | 0.2 |
| 63 TANTAN | | | | 1 | | 1 | 0.2 |
| 66 TAROUDANT | | | | 1 | | 1 | 0.2 |
| 73 TIZNIT | | | | 1 | | 1 | 0.2 |
| 85 RABAT SALE | | | | 1 | | 1 | 0.2 |
| ES SMARA | | | | 1 | | 1 | 0.2 |
| LAAYOUNE | | | | 1 | | 1 | 0.2 |
| OUED EDDAHAB | | | | 1 | | 1 | 0.2 |
| 01 AGADIR | | | | | | 0 | 0 |
| 09 BEN SLIMANE | | | | | | 0 | 0 |
| 17 EL JADIDA | | | | | | 0 | 0 |
| 49 NADOR | | | | | | 0 | 0 |
| 72 LARACHE | | | | | | 0 | 0 |
| 79 BEN MSIK SD OT | | | | | | 0 | 0 |
| 75 A.CHOC A | | | | | | 0 | 0 |
| 81 CASA ANFAO | | | | | | 0 | 0 |
| 31 GUELMIM | | | | | | 0 | 0 |
| 83 MOH ZENATA | | | | | | 0 | 0 |

Source: National Master Plan

(4) = 2* (1)+1* (2)+1* (3)

(1) 0 = less than 120 cases/provinc (2) 0=incidence rate <50/100000 (3) 0=less than 100 cases/1000

1=120 to 200 cases/provinces 1=incidence rate 50 - 150/100000 1=100 to112 cases/1000

2=incidence rate>150/100000 2=more than 112 cases/1000

Table 2.6.4 Prevalance of Common Diseases in the Last Five Years in the Study Area

| DISEASE/CONDITION | COMMON and SERIOUS | COMMON but not SERIOUS | SERIOUS but not COMMON | REMARKS |
|---|---|---|---|---|
| 1. CHOLERA | X | | | ALL PROVINCES |
| 2. DIARRHEAS | X | | | ALL PROVINCES |
| 3. TYPHOID | X | | | ONLY IN TAZA |
| 4. INTESTINAL WORMS | | X | | ALL PROVINCES |

Source: National Master Plan

**Table 2.6.5 Summary of Sources of Problems and Preventive Interventions**

| DISEASE/CONDITION | MAIN SOURCE OF PROBLEM | | | | | | FOCAL POINT OF INTERVENTION | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WATER QUALITY | WATER QUANTITY | EXCRETA DISPOSAL | WASTE DISPOSAL | HOUSING | EDUCATION | WATER SUPPLY | EXCRETA DISPOSAL | WASTE DISPOSAL | HOUSING | HEALTH CARE | EDUCATION |
| 1. CHOLERA | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| 2. DIARRHEAS | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| 3. TYPHOID | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| 4. INTESTINAL PARASITE RELATED | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |

Source: National Master Plan

Note : 3: MAXIMUM 2: MODERATE 1: LOW

Table 2.6.6 Summary of Complexity of Interventions

| DISEASE/CONDITION | AREAS OF FOCUS | | | TIME SPAN | | | | INTEGRATION | CRITICAL MASS | INPUTS : | | PERCEIVED PRIORITY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USER | ENVIRON-MENT | HEALTH SYSTEM | LONG SHORT | RECU-RRENT | INITIATE | IMPACT | HARD =3 EASY =1 | HIGH =3 LOW =1 | LABOR SKILLED =3 UNSKILLED =1 | MATERIAL OUTSIDE LOCAL | NEED | PROGRAM |
| 1. CHOLERA | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 1 |
| 2. DIARRHEAS | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 1 |
| 3. TYPHOID | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 1 |
| 4. INTESTINAL PARASITE RELATED | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 1 |

Source: National Master Plan

Note: 3: MAXIMUM 2: MODERATE 1: LOW

## Table 3.3.1 Hydrogeological Characteristics of Exploratory Wells

| Model Area | Coordinates (Approx.) | | | Drilling | | Casing & Screen | | | Geology | |
|---|---|---|---|---|---|---|---|---|---|---|
| | X | Y | Z (m) | Dia. | Depth | Dia. | Casing | Screen | Epoch | Strata |
| **Teroual** | | | | | | | | | | |
| IRE 1531/9 (TRA 1) | 511300 | 452550 | 420 | 20"<br>12.25" | 10 m<br>10-250 | 16" | 10 m | — | Miocene<br>Oligocene<br>Triassic | Marl<br>Siltstone<br>Salt |
| IRE 1514/9 (TRA 2) | 510900 | 552225 | 335.8 | 24"<br>17"<br>12.25" | 10 m<br>10-170<br>170-300 | 20"<br>14"<br>14" | 10 m<br>170 m<br>— | 36 m<br>45 to 120 m | Miocene<br>Oligocene | Marl<br>Siltstone<br>Marl lime |
| IRE 1528/9 (TRA 3) | 510650 | 452150 | 337.7 | 20"<br>15"<br>12.25" | 10 m<br>10-120<br>120-150 | 16"<br>10"<br>10" | 10 m<br>120 m | 36 m<br>84 to 120 m | Miocene<br>Oligocene | Marl &<br>Gravel<br>Siltstone |
| **J.Berda** | | | | | | | | | | |
| IRE 1528/9 (JBD 1) | 548125 | 447100 | 573.5 | 20"<br>15" | 10 m<br>10-67 | 16" | 10 m | — | Jurassic<br>Upper<br>Cretaceous | Boulders<br>Marlstone<br>Schist |
| IRE 1527/9 (JBD 2) | 549450 | 446800 | 810.5 | 20"<br>15" | 10 m<br>10-150 | 16"<br>10"<br>10" | 10 m<br>150 m | 60 m<br>62 to 144 m | Jurassic<br>Upper<br>Cretaceous | Boulders<br>Marlstone<br>Schist |
| IRE 1526/9 (JBD 3) | 550150 | 446925 | 810.9 | 20"<br>15" | 10 m<br>10-100 | 16"<br>10"<br>10" | 10 m<br>100 m | 36 m<br>32 to 100 m | Jurassic<br>Upper<br>Cretaceous | Boulders<br>Marlstone<br>Schist |
| **Ain Defali** | | | | | | | | | | |
| IRE 3397/8 (ADF 1) | 484500 | 445550 | 143.9 | 20"<br>15" | 5 m<br>5-76 | 16"<br>10"<br>10" | 5 m<br>125 m | 36 m<br>16 to 70 m | Quaternary<br>Villafranchian | Conglomerate |
| IRE 1537/9 (ADF 2) | 485225 | 445575 | 459.4 | 20"<br>15" | 5 m<br>5-55 | 16"<br>10"<br>10" | 5 m<br>55 m | 30 m<br>13 to 49 m | Quaternary<br>Villafranchian | Conglomerate |
| IRE 1538/9 (ADF 3) | 485925 | 445550 | 169.8 | 20"<br>15"<br>12.25" | 5 m<br>5-125<br>125-150 | 16"<br>10"<br>10" | 5 m<br>125 m | 76 m<br>13 to 119 m | Quaternary<br>Villafranchian | Conglomerate |

## Table 3.3.2 Technical Details of Pumping Tests of Exploratory Wells

| Model Area | Well Reference No. | Pumping Test | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Development Test | | | | | | | Step Drawdown | | | | | | | | |
| | | Well Depth (m) | Date of Test | Time (hr) | Stage (Nos.) | SWL (m) | Yield (l/sec) | Draw-down (m) | Date | Time (hr) | Stage (Nos.) | SWL (m) | Yield (l/sec) | Draw-down (m) | Specific Drawdown (sec/m2) | Well Loss (sec/m5) | Formation Loss (sec/m5) |
| Teroual | IRE 1531/9 (TRA1) | 250 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | IRE 1514/9 (TRA2) | 300 | 10/9/95<br>11/9/95 | 24 | 1 | 62.50 | 10 | 28.20 | 12/9/95 | 8 | 4<br>2 hrs each | 63.25 | 2.5<br>5.0<br>7.5<br>10.0 | 6.67<br>12.75<br>18.60<br>21.12 | 2668<br>2550<br>2480<br>2112 | 68000 | 1080 |
| | IRE 1515/9 (TRA3) | 150 | 20/9/95<br>21/9/95 | 10 | 1 | 38.36 | 10 | 4.02 | 2/9/95 | 8 | 4<br>2 hrs each | 68.46 | 2.5<br>5.0<br>7.5<br>10.0 | 0.05<br>0.12<br>0.20<br>0.34 | 20<br>24<br>26.6<br>34 | 500 | 17 |
| J. Berda | IRE 1528/9 (JBD1) | 67 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | IRE 1527/9 (JBD2) | 150 | 13/9/95<br>14/9/95 | 24 | 1 | 61.45 | 10 | 32.52 | 14/9/95 | 8 | 4<br>2 hrs each | 61.38 | 2.5<br>5.0<br>7.5<br>10.0 | 4.49<br>10.57<br>17.27<br>26.40 | 1796<br>2114<br>2302<br>2640 | 250 | 25 |
| | IRE 1526/9 (JBD3) | 100 | 16/9/95<br>19/9/95 | 64 | 1 | 34.68 | 1.5 | 0.52 | 25/8/95 | 8 | 4<br>2 hrs each | 34.79 | 0.5<br>1.0<br>1.5<br>2.0 | 0.18<br>0.38<br>1.01<br>2.19 | 360<br>380<br>673<br>1095 | 360000 | 90 |
| Ain Defali | IRE 3397/8 (ADF1) | 76 | 23/8/95<br>24/8/95 | 24 | 3<br>6 hrs each | 4.03 | 10<br>15<br>18.5 | 7.39<br>12.35<br>16.14 | 26/8/95 | 8 | 4<br>2 hrs each | 8.51 | 5.3<br>10.6<br>15.0<br>17.6 | 10.76<br>13.85<br>16.59<br>18.54 | 2030<br>1307<br>1106<br>1053 | 10000 | 35 |
| | IRE 1537/9 (ADF2) | 55 | 3/8/95<br>18/8/95 | 12<br>12 | 2<br>2 x 6 hrs<br>1 x12 hrs | 2.75 | 4.5<br>6.0<br>9.5-7.6 | 10.12<br>14.70<br>44.15 | 21/8/95 | 8 | 4<br>2 hrs each | 3.10 | 2.0<br>4.0<br>6.0<br>7.6 | 7.57<br>15.03<br>27.38<br>42.55 | 3785<br>3757<br>4563<br>4599 | 270000 | 250 |
| | IRE 1538/9 (ADF3) | 150 | 15/9/95<br>16/9/95 | 24 | 1 | 32.38 | 10 | 38.28 | 16/9/95 | 8 | 4<br>2 hrs each | 32.50 | 2.5<br>5.0<br>7.5<br>10.0 | 2.97<br>7.28<br>13.37<br>32.28 | 1188<br>1456<br>1783<br>3228 | 70000 | 150 |

## Table 3.3.3 Technical Details of Constant Rate Pumping and Recovery Tests of Exploratory Wells

| Model Area | Well Reference No. | Pumping Test | | | | | | | | | Recovery | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Constant Rate | | | | | | | | | | |
| | | Well Depth (m) | Date of Test | Time (hr) | SWL (m) | Yield (l/sec) | Drawdown (m) | Tranmi-ssivity (m2/sec) | Effective Permeability (m/sec) | Storage Coefficient | Original SWL (m) | Tranmi-ssivity (m2/sec) |
| Teroual | IRE 1531/9 (TRA1) | 250 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | IRE 1514/9 (TRA2) | 300 | 24/6/95<br>27/9/95 | 72 | 63.97 | 10 | 21.60 | 9.8 x 10-4 | 1.63 x 10-5 | 4.36 x 10-4 | 40 | 6.09 x 10-4 |
| | IRE 1515/9 (TRA3) | 150 | 22/9/95<br>23/9/95 | 37 | 68.52 | 10 | 0.68 | 8.73 x 10-3 | 2.49 x 10-4 | 4.8 x 10-3 | 14 | 1.81 x 10-2 |
| J. Berda | IRE 1528/9 (JBD1) | 67 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | IRE 1527/9 (JBD2) | 150 | 15/9/95<br>18/9/95 | 60<br>12 | 61.45 | 8<br>11 | 25.05<br>31.42 | 4.88 x 10-4 | 1.83 x 10-5 | 2.5 x 10-3 (estimated) | 41 | 1.56 x 10-3 |
| | IRE 1526/9 (JBD3) | 100 | 26/8/95<br>29/8/95 | 72<br>10 | 34.76 | 2<br>2.5 | 42.64<br>48.19 | 9.8 x 10-5 | 1.50 x 10-6 | 2.5 x 10-3 (estimated) | 21 | 2.08 x 10-4 |
| Ain Defali | IRE 3397/8 (ADF1) | 76 | 27/8/95<br>30/8/95 | 72 | 8.8 | 15 | 14.35 | 1.8 x 10-3 | 1.8 x 10-5 | 1.5 x 10-3 (estimated) | 72 | 1.14 x 10-3 |
| | IRE 1537/9 (ADF2) | 55 | 22/8/95<br>25/8/95 | 72 | 7.43 | 5 | 31.82 | 1.17 x 10-4 | 1.06 x 10-6 | 1.5 x 10-3 (estimated) | 72 | 2.03 x 10-4 |
| | IRE 1538/9 (ADF3) | 150 | 17/9/95<br>20/9/95 | 72 | 32.5 | 10<br>12 | 23.45<br>23.41 | 9.14 x 10-4 | 1.08 x 10-5 | 1.5 x 10-3 (estimated) | 26 | 1.35 x 10-3 |

**Table 3.3.4 List of Data Used for Tank Model**

| River Basin | Rdat | Amzaz |
|---|---|---|
| Precipitation | | |
| Reference Station | 4404 Had Kourt | 6400 Rhafsai |
| Period | 1957/58 - 1993/94 | 1957/58 - 1993/94 |
| Multiplier for Converting into Basin Rainfall | 1.40 | 1.29 |
| Runoff | | |
| Reference Station | 1436/8 Had Kourt | 607/9 Rhafsai |
| Period | 1957/58 - 1993/94 | 1957/58 - 1993/94 |
| Catchment Area | 673 km2 | 777 km2 |
| Evapotranspiration | | |
| Reference Station | 6200 Ourtzagh | 6200 Ourtzagh |

**Table 3.3.5 Application of Tank Model for Objective Area**

| Objective Area | Ain Defali | Teroual | J. Berda |
|---|---|---|---|
| Catchment Area | 12.0 km2 | 6.1 km2 | 6.3 km2 |
| Applied Tank Model | Rdat | Rdat | Amzaz |
| Precipitation | | | |
| Reference Station | 4404 Had Kourt | 5128 M'Jaara | 6400 Rhafsai |
| Period | 1957/58 - 1994/95 | 1957/58 - 1994/95 | 1957/58 - 1994/95 |
| Multiplier for Converting into Basin Rainfall | 1.15 | 1.29 | 1.11 |
| Evapotranspiration | | | |
| Reference Station | 6200 Ourtzagh | 6200 Ourtzagh | 6200 Ourtzagh |

**Table 3.4.1 Water Demand in the Model Area (Ain Defali Commune), 1995**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand Domestic (l/c/d) | Unit Water Demand Livestock (l/head/d) | Net Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Aaoufat | 320 | 256 | 282 | 20 | 20 | 6.0 | 40 | 10.0 |
| 2 | Ain Chamia | 710 | 568 | 316 | 20 | 20 | 12.3 | 40 | 20.5 |
| 3 | Ain Defali | 750 | 600 | 0 | 20 | 20 | 12.0 | 40 | 20.0 |
| 4 | Ain Seddine | 100 | 80 | 296 | 20 | 20 | 2.5 | 40 | 4.2 |
| 5 | Ain Sfessef | 102 | 82 | 36 | 20 | 20 | 1.7 | 40 | 2.8 |
| 6 | Amama | 350 | 280 | 64 | 20 | 20 | 5.8 | 40 | 9.7 |
| 7 | Bni Chellah | 250 | 200 | 123 | 20 | 20 | 4.4 | 40 | 7.3 |
| 8 | Bni Sennana | 640 | 512 | 172 | 20 | 20 | 10.8 | 40 | 18.0 |
| 9 | Bni Zid | 850 | 680 | 292 | 20 | 20 | 14.5 | 40 | 24.2 |
| 10 | Bouajajat | 74 | 59 | 42 | 20 | 20 | 1.3 | 40 | 2.2 |
| 11 | Bouajoulat | 261 | 209 | 288 | 20 | 20 | 5.0 | 40 | 8.3 |
| 12 | Boukouirat | 250 | 200 | 74 | 20 | 20 | 4.2 | 40 | 7.0 |
| 13 | Chaouia Bir | 730 | 584 | 496 | 20 | 20 | 13.2 | 40 | 22.0 |
| 14 | Chaouia Bouryatel | 550 | 440 | 270 | 20 | 20 | 9.6 | 40 | 16.0 |
| 15 | Chaouia Rmel | 1,032 | 826 | 870 | 20 | 20 | 19.1 | 40 | 31.8 |
| 16 | Chleuh | 140 | 112 | 115 | 20 | 20 | 2.6 | 40 | 4.3 |
| 17 | Daaf Lahfira | 230 | 184 | 210 | 20 | 20 | 4.3 | 40 | 7.2 |
| 18 | Daaf Ould Ali | 100 | 80 | 170 | 20 | 20 | 2.1 | 40 | 3.5 |
| 19 | Dhar Kharaz | 158 | 126 | 78 | 20 | 20 | 2.8 | 40 | 4.7 |
| 20 | Driouchat | 96 | 77 | 99 | 20 | 20 | 1.8 | 40 | 3.0 |
| 21 | Fadilia | 345 | 276 | 242 | 20 | 20 | 6.2 | 40 | 10.3 |
| 22 | Fssahiyen | 224 | 179 | 78 | 20 | 20 | 3.8 | 40 | 6.3 |
| 23 | Hjafna Rdat | 800 | 640 | 370 | 20 | 20 | 13.9 | 40 | 23.2 |
| 24 | Jaaouna | 192 | 154 | 75 | 20 | 20 | 3.3 | 40 | 5.5 |
| 25 | Jdid | 700 | 560 | 230 | 20 | 20 | 11.9 | 40 | 19.8 |
| 26 | Jraouna | 300 | 240 | 111 | 20 | 20 | 5.1 | 40 | 8.5 |
| 27 | Kelaa | 219 | 175 | 40 | 20 | 20 | 3.6 | 40 | 6.0 |
| 28 | Khobzianne | 790 | 632 | 132 | 20 | 20 | 13.0 | 40 | 21.7 |
| 29 | Krones | 320 | 256 | 58 | 20 | 20 | 5.3 | 40 | 8.8 |
| 30 | Kraoucha | 720 | 576 | 249 | 20 | 20 | 12.3 | 40 | 20.5 |
| 31 | Laamirat | 616 | 493 | 147 | 20 | 20 | 10.3 | 40 | 17.2 |
| 32 | Laaouaoula | 700 | 560 | 115 | 20 | 20 | 11.5 | 40 | 19.2 |
| 33 | Lahasba | 126 | 101 | 96 | 20 | 20 | 2.3 | 40 | 3.8 |
| 34 | Lahjafra Bougdour | 720 | 576 | 1,006 | 20 | 20 | 14.5 | 40 | 24.2 |
| 35 | Lahjajma | 894 | 715 | 574 | 20 | 20 | 16.0 | 40 | 26.7 |
| 36 | Lahrahra | 250 | 200 | 82 | 20 | 20 | 4.2 | 40 | 7.0 |
| 37 | Maadid | 60 | 48 | 78 | 20 | 20 | 1.2 | 40 | 2.0 |
| 38 | Mkam Mougui | 70 | 56 | 270 | 20 | 20 | 1.9 | 40 | 3.2 |
| 39 | Moualda | 372 | 298 | 194 | 20 | 20 | 6.5 | 40 | 10.8 |
| 40 | Mrabih | 454 | 363 | 293 | 20 | 20 | 8.1 | 40 | 13.5 |
| 41 | Ouled Bouchriha | 350 | 280 | 200 | 20 | 20 | 6.2 | 40 | 10.3 |
| 42 | Ouled Mahyou | 291 | 233 | 116 | 20 | 20 | 5.0 | 40 | 8.3 |
| 43 | Ouled Selem | 110 | 88 | 106 | 20 | 20 | 2.1 | 40 | 3.5 |
| 44 | Ouled Aaroub | 0 | 0 | 0 | 20 | 20 | 0.0 | 40 | 0.0 |
| 45 | Ouled Benyefou | 378 | 302 | 520 | 20 | 20 | 7.6 | 40 | 12.7 |
| 46 | Ouled Bouainer | 90 | 72 | 135 | 20 | 20 | 1.8 | 40 | 3.0 |
| 47 | Ouled Bouayeb | 190 | 152 | 85 | 20 | 20 | 3.3 | 40 | 5.5 |
| 48 | Ouled Boubker | 427 | 342 | 135 | 20 | 20 | 7.2 | 40 | 12.0 |
| 49 | Ouled Glaid | 820 | 656 | 354 | 20 | 20 | 14.2 | 40 | 23.7 |
| 50 | Ouled Ktir | 2,240 | 1,792 | 560 | 20 | 20 | 37.5 | 40 | 62.5 |
| 51 | Ouled Nboal | 200 | 160 | 122 | 20 | 20 | 3.6 | 40 | 6.0 |
| 52 | Regada | 70 | 56 | 64 | 20 | 20 | 1.3 | 40 | 2.2 |
| 53 | Slahma | 231 | 185 | 209 | 20 | 20 | 4.3 | 40 | 7.2 |
| 54 | Slim | 1,536 | 1,229 | 122 | 20 | 20 | 24.9 | 40 | 41.5 |
| 55 | Souhali | 210 | 168 | 350 | 20 | 20 | 4.4 | 40 | 7.3 |
| 56 | Souissat | 270 | 216 | 69 | 20 | 20 | 4.5 | 40 | 7.5 |
| 57 | Ain Masinouda | 20 | 16 | 73 | 20 | 20 | 0.5 | 40 | 0.8 |
| 58 | Laouinala Sayed | 100 | 80 | 44 | 20 | 20 | 1.7 | 40 | 2.8 |
| 59 | Coop El Assira | 88 | 70 | 200 | 20 | 20 | 2.0 | 40 | 3.3 |
| 60 | R. Center Ain Defali | 1,048 | 838 | 180 | 20 | 20 | 17.3 | 40 | 28.8 |
| | Total | 25,234 | 20,188 | 12,377 | - | - | 440.3 | - | 733.8 |

Note: Numbers of population and livestock in Ouled Aaroub douar are included in Lahrahara douar, since these douars are alocated very near to each other.

**Table 3.4.2 Water Demand in the Model Area (Ain Defali Commune), 2000**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand Domestic (l/c/d) | Unit Water Demand Livestock (l/head/d) | Net Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Aaoufat | 331 | 265 | 282 | 23 | 20 | 6.9 | 35 | 10.6 |
| 2 | Ain Chamia | 735 | 588 | 316 | 23 | 20 | 14.5 | 35 | 22.3 |
| 3 | Ain Defali | 777 | 621 | 0 | 23 | 20 | 14.3 | 35 | 22.0 |
| 4 | Ain Seddine | 104 | 83 | 296 | 23 | 20 | 2.8 | 35 | 4.3 |
| 5 | Ain Sfessef | 106 | 84 | 36 | 23 | 20 | 2.0 | 35 | 3.1 |
| 6 | Amama | 362 | 290 | 64 | 23 | 20 | 6.9 | 35 | 10.6 |
| 7 | Bni Chellah | 259 | 207 | 123 | 23 | 20 | 5.1 | 35 | 7.8 |
| 8 | Bni Sennana | 663 | 530 | 172 | 23 | 20 | 12.7 | 35 | 19.5 |
| 9 | Bni Zid | 880 | 704 | 292 | 23 | 20 | 17.1 | 35 | 26.3 |
| 10 | Bouajajat | 77 | 61 | 42 | 23 | 20 | 1.5 | 35 | 2.3 |
| 11 | Bouajoulat | 270 | 216 | 288 | 23 | 20 | 5.8 | 35 | 8.9 |
| 12 | Boukouiratt | 259 | 207 | 74 | 23 | 20 | 5.0 | 35 | 7.7 |
| 13 | Chaouia Bir | 756 | 605 | 496 | 23 | 20 | 15.4 | 35 | 23.7 |
| 14 | Chaouia Bouryatel | 570 | 456 | 270 | 23 | 20 | 11.3 | 35 | 17.4 |
| 15 | Chaouia Rmel | 1,069 | 855 | 870 | 23 | 20 | 22.3 | 35 | 34.3 |
| 16 | Chleuh | 145 | 116 | 115 | 23 | 20 | 3.0 | 35 | 4.6 |
| 17 | Daaf Lahfira | 238 | 191 | 210 | 23 | 20 | 5.0 | 35 | 7.7 |
| 18 | Daaf Ould Ali | 104 | 83 | 170 | 23 | 20 | 2.4 | 35 | 3.7 |
| 19 | Dhar Kharaz | 164 | 131 | 78 | 23 | 20 | 3.2 | 35 | 4.9 |
| 20 | Driouchat | 99 | 80 | 99 | 23 | 20 | 2.1 | 35 | 3.2 |
| 21 | Fadilia | 357 | 286 | 242 | 23 | 20 | 7.3 | 35 | 11.2 |
| 22 | Fssahiyen | 232 | 186 | 78 | 23 | 20 | 4.5 | 35 | 6.9 |
| 23 | Hjafna Rdat | 828 | 663 | 370 | 23 | 20 | 16.4 | 35 | 25.2 |
| 24 | Jaaouna | 199 | 159 | 75 | 23 | 20 | 3.9 | 35 | 6.0 |
| 25 | Jdid | 725 | 580 | 230 | 23 | 20 | 14.0 | 35 | 21.5 |
| 26 | Jramna | 311 | 249 | 111 | 23 | 20 | 6.1 | 35 | 9.4 |
| 27 | Kelaa | 227 | 181 | 40 | 23 | 20 | 4.3 | 35 | 6.6 |
| 28 | Khobzianne | 818 | 654 | 132 | 23 | 20 | 15.4 | 35 | 23.7 |
| 29 | Kranes | 331 | 265 | 58 | 23 | 20 | 6.3 | 35 | 9.7 |
| 30 | Kraoucha | 746 | 596 | 249 | 23 | 20 | 14.5 | 35 | 22.3 |
| 31 | Laamirat | 638 | 510 | 147 | 23 | 20 | 12.2 | 35 | 18.8 |
| 32 | Laaouaoula | 725 | 580 | 115 | 23 | 20 | 13.7 | 35 | 21.1 |
| 33 | Lahasba | 130 | 104 | 96 | 23 | 20 | 2.7 | 35 | 4.2 |
| 34 | Lahjafra Bougdour | 746 | 596 | 1,006 | 23 | 20 | 16.7 | 35 | 25.7 |
| 35 | Lahjajma | 926 | 741 | 574 | 23 | 20 | 18.8 | 35 | 28.9 |
| 36 | Lahrahra | 259 | 207 | 82 | 23 | 20 | 5.0 | 35 | 7.7 |
| 37 | Maadid | 62 | 50 | 78 | 23 | 20 | 1.4 | 35 | 2.2 |
| 38 | Mkam Mougui | 72 | 58 | 270 | 23 | 20 | 2.1 | 35 | 3.2 |
| 39 | Moualda | 385 | 308 | 194 | 23 | 20 | 7.7 | 35 | 11.8 |
| 40 | Mrabih | 470 | 376 | 293 | 23 | 20 | 9.5 | 35 | 14.6 |
| 41 | Ouled Bouchriha | 362 | 290 | 200 | 23 | 20 | 7.3 | 35 | 11.2 |
| 42 | Ouled Mahyou | 301 | 241 | 116 | 23 | 20 | 5.9 | 35 | 9.1 |
| 43 | Ouled Selem | 114 | 91 | 106 | 23 | 20 | 2.4 | 35 | 3.7 |
| 44 | Ouled Aaroub | 0 | 0 | 0 | 23 | 20 | 0.0 | 35 | 0.0 |
| 45 | Ouled Benyefou | 391 | 313 | 520 | 23 | 20 | 8.8 | 35 | 13.5 |
| 46 | Ouled Bouamer | 93 | 75 | 135 | 23 | 20 | 2.1 | 35 | 3.2 |
| 47 | Ouled Bouayeb | 197 | 157 | 85 | 23 | 20 | 3.9 | 35 | 6.0 |
| 48 | Ouled Boubker | 442 | 354 | 135 | 23 | 20 | 8.5 | 35 | 13.1 |
| 49 | Ouled Glaid | 849 | 679 | 354 | 23 | 20 | 16.7 | 35 | 25.7 |
| 50 | Ouled Ktir | 2,320 | 1,856 | 560 | 23 | 20 | 44.4 | 35 | 68.3 |
| 51 | Ouled Noual | 207 | 166 | 122 | 23 | 20 | 4.2 | 35 | 6.5 |
| 52 | Regada | 72 | 58 | 64 | 23 | 20 | 1.5 | 35 | 2.3 |
| 53 | Stahma | 239 | 191 | 209 | 23 | 20 | 5.0 | 35 | 7.7 |
| 54 | Slim | 1,591 | 1,272 | 122 | 23 | 20 | 29.6 | 35 | 45.5 |
| 55 | Souhatt | 217 | 174 | 350 | 23 | 20 | 5.1 | 35 | 7.8 |
| 56 | Souissat | 280 | 224 | 69 | 23 | 20 | 5.4 | 35 | 8.3 |
| 57 | Ain Masmouda | 21 | 17 | 73 | 23 | 20 | 0.6 | 35 | 0.9 |
| 58 | Laoumala Sayed | 104 | 83 | 44 | 23 | 20 | 2.0 | 35 | 3.1 |
| 59 | Coop El Assira | 91 | 73 | 200 | 23 | 20 | 2.3 | 35 | 3.5 |
| 60 | R. Center Ain Defali | 1,085 | 868 | 180 | 23 | 20 | 20.5 | 35 | 31.5 |
| | Total | 26,130 | 20,904 | 12,377 | - | - | 518.0 | - | 796.9 |

Note: Numbers of population and livestock in Ouled Aaroub douar are included in Lahrahara douar, since these douars are alocated very near to each other.

**Table 3.4.3 Water Demand in the Model Area (Ain Defali Commune), 2005**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand Domestic (l/c/d) | Unit Water Demand Livestock (l/head/d) | Net Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Aaoufat | 343 | 274 | 282 | 27 | 20 | 8.2 | 30 | 11.7 |
| 2 | Ain Chamia | 761 | 609 | 316 | 27 | 20 | 17.4 | 30 | 24.9 |
| 3 | Ain Defali | 804 | 643 | 0 | 27 | 20 | 17.4 | 30 | 24.9 |
| 4 | Ain Seddine | 107 | 86 | 296 | 27 | 20 | 3.2 | 30 | 4.6 |
| 5 | Ain Sfessef | 109 | 87 | 36 | 27 | 20 | 2.5 | 30 | 3.6 |
| 6 | Amama | 375 | 300 | 64 | 27 | 20 | 8.3 | 30 | 11.9 |
| 7 | Bni Chellah | 268 | 214 | 123 | 27 | 20 | 6.1 | 30 | 8.7 |
| 8 | Bni Sennana | 686 | 549 | 172 | 27 | 20 | 15.3 | 30 | 21.9 |
| 9 | Bni Zid | 911 | 729 | 292 | 27 | 20 | 20.6 | 30 | 29.4 |
| 10 | Bouajajat | 79 | 63 | 42 | 27 | 20 | 1.8 | 30 | 2.6 |
| 11 | Bouajoulat | 280 | 224 | 288 | 27 | 20 | 6.9 | 30 | 9.9 |
| 12 | Boukoulratt | 268 | 214 | 74 | 27 | 20 | 6.0 | 30 | 8.6 |
| 13 | Chaouia Bir | 783 | 626 | 496 | 27 | 20 | 18.4 | 30 | 26.3 |
| 14 | Chaouia Bouryatel | 590 | 472 | 270 | 27 | 20 | 13.6 | 30 | 19.4 |
| 15 | Chaouia Rmel | 1,107 | 885 | 870 | 27 | 20 | 26.5 | 30 | 37.9 |
| 16 | Chleuh | 150 | 120 | 115 | 27 | 20 | 3.6 | 30 | 5.1 |
| 17 | Daaf Lahfira | 247 | 197 | 210 | 27 | 20 | 5.9 | 30 | 8.4 |
| 18 | Daaf Ould Ali | 107 | 86 | 170 | 27 | 20 | 2.8 | 30 | 4.0 |
| 19 | Dhar Kharaz | 169 | 136 | 78 | 27 | 20 | 3.9 | 30 | 5.6 |
| 20 | Driouchat | 103 | 82 | 99 | 27 | 20 | 2.5 | 30 | 3.6 |
| 21 | Fadilia | 370 | 296 | 242 | 27 | 20 | 8.7 | 30 | 12.4 |
| 22 | Fssahiyen | 240 | 192 | 78 | 27 | 20 | 5.4 | 30 | 7.7 |
| 23 | Hjafna Rdat | 858 | 686 | 370 | 27 | 20 | 19.6 | 30 | 28.0 |
| 24 | Jaaouna | 206 | 165 | 75 | 27 | 20 | 4.7 | 30 | 6.7 |
| 25 | Jdid | 751 | 600 | 230 | 27 | 20 | 16.9 | 30 | 24.1 |
| 26 | Jramna | 322 | 257 | 111 | 27 | 20 | 7.3 | 30 | 10.4 |
| 27 | Kelaa | 235 | 188 | 40 | 27 | 20 | 5.2 | 30 | 7.4 |
| 28 | Khobzianne | 847 | 678 | 132 | 27 | 20 | 18.7 | 30 | 26.7 |
| 29 | Kranes | 343 | 274 | 58 | 27 | 20 | 7.6 | 30 | 10.9 |
| 30 | Kraoucha | 772 | 618 | 249 | 27 | 20 | 17.4 | 30 | 24.9 |
| 31 | Laamirat | 661 | 528 | 147 | 27 | 20 | 14.7 | 30 | 21.0 |
| 32 | Laaouaoula | 751 | 600 | 115 | 27 | 20 | 16.5 | 30 | 23.6 |
| 33 | Lahasba | 135 | 108 | 96 | 27 | 20 | 3.2 | 30 | 4.6 |
| 34 | Lahjafra Bougdour | 772 | 618 | 1,006 | 27 | 20 | 19.7 | 30 | 28.1 |
| 35 | Lahjajna | 959 | 767 | 574 | 27 | 20 | 22.4 | 30 | 32.0 |
| 36 | Lahrahra | 268 | 214 | 82 | 27 | 20 | 6.0 | 30 | 8.6 |
| 37 | Maadid | 64 | 51 | 78 | 27 | 20 | 1.6 | 30 | 2.3 |
| 38 | Mkam Mougui | 75 | 60 | 270 | 27 | 20 | 2.4 | 30 | 3.4 |
| 39 | Moualda | 399 | 319 | 194 | 27 | 20 | 9.2 | 30 | 13.1 |
| 40 | Mrabih | 487 | 389 | 293 | 27 | 20 | 11.4 | 30 | 16.3 |
| 41 | Ouled Bouchriha | 375 | 300 | 200 | 27 | 20 | 8.7 | 30 | 12.4 |
| 42 | Ouled Mahyou | 312 | 250 | 116 | 27 | 20 | 7.1 | 30 | 10.1 |
| 43 | Ouled Selem | 118 | 94 | 106 | 27 | 20 | 2.9 | 30 | 4.1 |
| 44 | Ouled Aaroub | 0 | 0 | 0 | 27 | 20 | 0.0 | 30 | 0.0 |
| 45 | Ouled Benyefou | 405 | 324 | 520 | 27 | 20 | 10.3 | 30 | 14.7 |
| 46 | Ouled Bouamer | 97 | 77 | 135 | 27 | 20 | 2.5 | 30 | 3.6 |
| 47 | Ouled Bouayeb | 204 | 163 | 85 | 27 | 20 | 4.7 | 30 | 6.7 |
| 48 | Ouled Boubker | 458 | 366 | 135 | 27 | 20 | 10.3 | 30 | 14.7 |
| 49 | Ouled Glaid | 879 | 703 | 354 | 27 | 20 | 20.0 | 30 | 28.6 |
| 50 | Ouled Ktir | 2,402 | 1,921 | 560 | 27 | 20 | 53.5 | 30 | 76.4 |
| 51 | Ouled Noual | 214 | 172 | 122 | 27 | 20 | 5.0 | 30 | 7.1 |
| 52 | Regada | 75 | 60 | 64 | 27 | 20 | 1.8 | 30 | 2.6 |
| 53 | Slahma | 248 | 198 | 209 | 27 | 20 | 6.0 | 30 | 8.6 |
| 54 | Stim | 1,647 | 1,318 | 122 | 27 | 20 | 36.0 | 30 | 51.4 |
| 55 | Souhatt | 225 | 180 | 350 | 27 | 20 | 5.9 | 30 | 8.4 |
| 56 | Souissat | 290 | 232 | 69 | 27 | 20 | 6.5 | 30 | 9.3 |
| 57 | Ain Masmouda | 21 | 17 | 73 | 27 | 20 | 0.7 | 30 | 1.0 |
| 58 | Laoumala Sayed | 107 | 86 | 44 | 27 | 20 | 2.5 | 30 | 3.6 |
| 59 | Coop El Assira | 94 | 75 | 200 | 27 | 20 | 2.6 | 30 | 3.7 |
| 60 | R. Center Ain Defali | 1,124 | 899 | 180 | 27 | 20 | 24.8 | 30 | 35.4 |
| | Total | 27,057 | 21,639 | 12,377 | - | - | 621.3 | - | 887.6 |

Note: Numbers of population and livestock in Ouled Aaroub douar are included in Lahrahara douar, since these douars are alocated very near to each other.

**Table 3.4.4 Water Demand in the Model Area (Ain Defali Commune), 2010**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand Domestic (l/c/d) | Unit Water Demand Livestock (l/head/d) | Net Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Aaoufat | 355 | 284 | 282 | 31 | 20 | 9.7 | 26 | 13.1 |
| 2 | Ain Chamia | 788 | 631 | 316 | 31 | 20 | 20.5 | 26 | 27.7 |
| 3 | Ain Defali | 833 | 666 | 0 | 31 | 20 | 20.6 | 26 | 27.8 |
| 4 | Ain Seddine | 111 | 89 | 296 | 31 | 20 | 3.6 | 26 | 4.9 |
| 5 | Ain Sfessef | 113 | 91 | 36 | 31 | 20 | 2.9 | 26 | 3.9 |
| 6 | Aimama | 389 | 311 | 64 | 31 | 20 | 9.8 | 26 | 13.2 |
| 7 | Bni Chellah | 278 | 222 | 123 | 31 | 20 | 7.3 | 26 | 9.9 |
| 8 | Bni Sennana | 711 | 568 | 172 | 31 | 20 | 18.1 | 26 | 24.5 |
| 9 | Bni Zid | 944 | 755 | 292 | 31 | 20 | 24.3 | 26 | 32.8 |
| 10 | Bouajajat | 82 | 66 | 42 | 31 | 20 | 2.2 | 26 | 3.0 |
| 11 | Bouajoulat | 290 | 232 | 288 | 31 | 20 | 8.1 | 26 | 10.9 |
| 12 | Boukouiratt | 278 | 222 | 74 | 31 | 20 | 7.1 | 26 | 9.6 |
| 13 | Chaouia Bir | 811 | 648 | 496 | 31 | 20 | 21.6 | 26 | 29.2 |
| 14 | Chaouia Bouryatel | 611 | 489 | 270 | 31 | 20 | 16.0 | 26 | 21.6 |
| 15 | Chaouia Rmel | 1,146 | 917 | 870 | 31 | 20 | 31.0 | 26 | 41.9 |
| 16 | Chleuh | 155 | 124 | 115 | 31 | 20 | 4.2 | 26 | 5.7 |
| 17 | Daaf Lahfira | 255 | 204 | 210 | 31 | 20 | 7.0 | 26 | 9.5 |
| 18 | Daaf Ould Ali | 111 | 89 | 170 | 31 | 20 | 3.3 | 26 | 4.5 |
| 19 | Dhar Kharaz | 175 | 140 | 78 | 31 | 20 | 4.6 | 26 | 6.2 |
| 20 | Driouchat | 107 | 85 | 99 | 31 | 20 | 2.9 | 26 | 3.9 |
| 21 | Fadilia | 383 | 306 | 242 | 31 | 20 | 10.2 | 26 | 13.8 |
| 22 | Fssahiyen | 249 | 199 | 78 | 31 | 20 | 6.4 | 26 | 8.6 |
| 23 | Hjafna Rdat | 888 | 711 | 370 | 31 | 20 | 23.2 | 26 | 31.4 |
| 24 | Jaaouna | 213 | 171 | 75 | 31 | 20 | 5.5 | 26 | 7.4 |
| 25 | Jdid | 777 | 622 | 230 | 31 | 20 | 20.0 | 26 | 27.0 |
| 26 | Jramna | 333 | 266 | 111 | 31 | 20 | 8.6 | 26 | 11.6 |
| 27 | Kelaa | 243 | 195 | 40 | 31 | 20 | 6.2 | 26 | 8.4 |
| 28 | Khobzianne | 877 | 702 | 132 | 31 | 20 | 22.2 | 26 | 30.0 |
| 29 | Kranes | 355 | 284 | 58 | 31 | 20 | 9.0 | 26 | 12.2 |
| 30 | Kraoucha | 799 | 640 | 249 | 31 | 20 | 20.6 | 26 | 27.8 |
| 31 | Laamirat | 684 | 547 | 147 | 31 | 20 | 17.4 | 26 | 23.5 |
| 32 | Laaouaoula | 777 | 622 | 115 | 31 | 20 | 19.6 | 26 | 26.5 |
| 33 | Lahasba | 140 | 112 | 96 | 31 | 20 | 3.8 | 26 | 5.1 |
| 34 | Lahjafra Bougdour | 799 | 640 | 1,006 | 31 | 20 | 22.9 | 26 | 30.9 |
| 35 | Lahjajina | 993 | 794 | 574 | 31 | 20 | 26.3 | 26 | 35.5 |
| 36 | Lahrahra | 278 | 222 | 82 | 31 | 20 | 7.1 | 26 | 9.6 |
| 37 | Maadid | 67 | 53 | 78 | 31 | 20 | 1.9 | 26 | 2.6 |
| 38 | Mkam Mougui | 78 | 62 | 270 | 31 | 20 | 2.7 | 26 | 3.6 |
| 39 | Moualda | 413 | 330 | 194 | 31 | 20 | 10.8 | 26 | 14.6 |
| 40 | Mrabih | 504 | 403 | 293 | 31 | 20 | 13.4 | 26 | 18.1 |
| 41 | Ouled Bouchriha | 389 | 311 | 200 | 31 | 20 | 10.2 | 26 | 13.8 |
| 42 | Ouled Mahyou | 323 | 258 | 116 | 31 | 20 | 8.3 | 26 | 11.2 |
| 43 | Ouled Selem | 122 | 98 | 106 | 31 | 20 | 3.4 | 26 | 4.6 |
| 44 | Ouled Aaroub | 0 | 0 | 0 | 31 | 20 | 0.0 | 26 | 0.0 |
| 45 | Ouled Benyefou | 420 | 336 | 520 | 31 | 20 | 12.0 | 26 | 16.2 |
| 46 | Ouled Bouamer | 100 | 80 | 135 | 31 | 20 | 2.9 | 26 | 3.9 |
| 47 | Ouled Bouayeb | 211 | 169 | 85 | 31 | 20 | 5.5 | 26 | 7.4 |
| 48 | Ouled Boubker | 474 | 379 | 135 | 31 | 20 | 12.2 | 26 | 16.5 |
| 49 | Ouled Glaid | 910 | 728 | 354 | 31 | 20 | 23.6 | 26 | 31.9 |
| 50 | Ouled Ktir | 2,487 | 1,990 | 560 | 31 | 20 | 63.4 | 26 | 85.7 |
| 51 | Ouled Noual | 222 | 178 | 122 | 31 | 20 | 5.9 | 26 | 8.0 |
| 52 | Regada | 78 | 62 | 64 | 31 | 20 | 2.1 | 26 | 2.8 |
| 53 | Slahma | 256 | 205 | 209 | 31 | 20 | 7.0 | 26 | 9.5 |
| 54 | Sliin | 1,705 | 1,364 | 122 | 31 | 20 | 42.7 | 26 | 57.7 |
| 55 | Souhali | 233 | 187 | 350 | 31 | 20 | 6.8 | 26 | 9.2 |
| 56 | Souissat | 300 | 240 | 69 | 31 | 20 | 7.6 | 26 | 10.3 |
| 57 | Ain Masmouda | 22 | 18 | 73 | 31 | 20 | 0.8 | 26 | 1.1 |
| 58 | Laoumala Sayed | 111 | 89 | 44 | 31 | 20 | 2.9 | 26 | 3.9 |
| 59 | Coop El Assira | 98 | 78 | 200 | 31 | 20 | 3.0 | 26 | 4.1 |
| 60 | R. Center Ain Defali | 1,164 | 931 | 180 | 31 | 20 | 29.4 | 26 | 39.7 |
| | Total | 28,017 | 22,415 | 12,377 | - | - | 732.3 | - | 989.6 |

Note: Numbers of population and livestock in Ouled Aaroub douar are included in Lahrahara douar, since these douars are alocated very near to each other.

## Table 3.4.5 Water Demand in the Model Area (Teroual Commune), 1995

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Net Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Achira | 210 | 168 | 170 | 20 | 20 | 3.9 | 40 | 6.5 |
| 2 | Ain Arsa | 350 | 280 | 186 | 20 | 20 | 6.2 | 40 | 10.3 |
| 3 | Ain Haddad | 480 | 384 | 151 | 20 | 20 | 8.1 | 40 | 13.5 |
| 4 | Amalou | 180 | 144 | 62 | 20 | 20 | 3.1 | 40 | 5.2 |
| 5 | Bakkara | 320 | 256 | 168 | 20 | 20 | 5.6 | 40 | 9.3 |
| 6 | Beriat Rmel | 190 | 152 | 0 | 20 | 20 | 3.0 | 40 | 5.0 |
| 7 | Ghbalou | 1,200 | 960 | 1,050 | 20 | 20 | 22.4 | 40 | 37.3 |
| 8 | Glita | 300 | 240 | 224 | 20 | 20 | 5.5 | 40 | 9.2 |
| 9 | Haddarine | 380 | 304 | 219 | 20 | 20 | 6.7 | 40 | 11.2 |
| 10 | Hajar Touil | 800 | 640 | 200 | 20 | 20 | 13.4 | 40 | 22.3 |
| 11 | Houmar | 131 | 105 | 0 | 20 | 20 | 2.1 | 40 | 3.5 |
| 12 | Inghar | 60 | 48 | 95 | 20 | 20 | 1.2 | 40 | 2.0 |
| 13 | Khandak Berd | 540 | 432 | 0 | 20 | 20 | 8.6 | 40 | 14.3 |
| 14 | Koudia | 240 | 192 | 104 | 20 | 20 | 4.2 | 40 | 7.0 |
| 15 | Lalla Aicha | 110 | 88 | 69 | 20 | 20 | 2.0 | 40 | 3.3 |
| 16 | Latamna | 240 | 192 | 87 | 20 | 20 | 4.1 | 40 | 6.8 |
| 17 | Merrakine | 150 | 120 | 60 | 20 | 20 | 2.6 | 40 | 4.3 |
| 18 | Mguerouel | 350 | 280 | 190 | 20 | 20 | 6.2 | 40 | 10.3 |
| 19 | Oulad Imrane | 100 | 80 | 122 | 20 | 20 | 2.0 | 40 | 3.3 |
| 20 | Oulad Bakkal | 380 | 304 | 92 | 20 | 20 | 6.4 | 40 | 10.7 |
| 21 | Oulad Lahcen | 110 | 88 | 88 | 20 | 20 | 2.0 | 40 | 3.3 |
| 22 | Remila | 170 | 136 | 133 | 20 | 20 | 3.1 | 40 | 5.2 |
| 23 | Sidi Allal Zghari | 900 | 720 | 140 | 20 | 20 | 14.8 | 40 | 24.7 |
| 24 | Troual | 2,050 | 1,640 | 0 | 20 | 20 | 32.8 | 40 | 54.7 |
| 25 | Zlayh | 170 | 136 | 127 | 20 | 20 | 3.1 | 40 | 5.2 |
| 26 | Zourak | 740 | 592 | 132 | 20 | 20 | 12.2 | 40 | 20.3 |
| 27 | Oulad Bentahar | 110 | 88 | 101 | 20 | 20 | 2.1 | 40 | 3.5 |
| 28 | Oulad Hmidou | 135 | 108 | 67 | 20 | 20 | 2.4 | 40 | 4.0 |
| 29 | Jamae El Ouad | 1,000 | 800 | 332 | 20 | 20 | 17.0 | 40 | 28.3 |
| | Total | 12,096 | 9,677 | 4,369 | - | - | 206.8 | - | 344.7 |

**Table 3.4.6 Water Demand in the Model Area (Teroual Commune), 2000**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Achira | 217 | 174 | 170 | 23 | 20 | 4.5 | 35 | 6.9 |
| 2 | Ain Arsa | 362 | 290 | 186 | 23 | 20 | 7.2 | 35 | 11.1 |
| 3 | Ain Haddad | 497 | 398 | 151 | 23 | 20 | 9.6 | 35 | 14.8 |
| 4 | Amalou | 186 | 149 | 62 | 23 | 20 | 3.6 | 35 | 5.5 |
| 5 | Bakkara | 331 | 265 | 168 | 23 | 20 | 6.6 | 35 | 10.2 |
| 6 | Beriat Rmel | 197 | 157 | 0 | 23 | 20 | 3.6 | 35 | 5.5 |
| 7 | Ghbalou | 1,243 | 994 | 1,050 | 23 | 20 | 26.0 | 35 | 40.0 |
| 8 | Glita | 311 | 249 | 224 | 23 | 20 | 6.4 | 35 | 9.8 |
| 9 | Haddarine | 393 | 315 | 219 | 23 | 20 | 7.9 | 35 | 12.2 |
| 10 | Hajar Touil | 828 | 663 | 200 | 23 | 20 | 15.8 | 35 | 24.3 |
| 11 | Houmar | 136 | 109 | 0 | 23 | 20 | 2.5 | 35 | 3.8 |
| 12 | Inghar | 62 | 50 | 95 | 23 | 20 | 1.4 | 35 | 2.2 |
| 13 | Khandak Berd | 559 | 447 | 0 | 23 | 20 | 10.3 | 35 | 15.8 |
| 14 | Koudia | 249 | 199 | 104 | 23 | 20 | 4.9 | 35 | 7.5 |
| 15 | Lalla Aicha | 114 | 91 | 69 | 23 | 20 | 2.3 | 35 | 3.5 |
| 16 | Latamna | 249 | 199 | 87 | 23 | 20 | 4.8 | 35 | 7.4 |
| 17 | Merrakine | 155 | 124 | 60 | 23 | 20 | 3.0 | 35 | 4.6 |
| 18 | Mguerouel | 362 | 290 | 190 | 23 | 20 | 7.2 | 35 | 11.1 |
| 19 | Oulad Imrane | 104 | 83 | 122 | 23 | 20 | 2.3 | 35 | 3.5 |
| 20 | Oulad Bakkal | 393 | 315 | 92 | 23 | 20 | 7.5 | 35 | 11.5 |
| 21 | Oulad Lahcen | 114 | 91 | 88 | 23 | 20 | 2.4 | 35 | 3.7 |
| 22 | Remila | 176 | 141 | 133 | 23 | 20 | 3.6 | 35 | 5.5 |
| 23 | Sidi Allal Zgbari | 932 | 746 | 140 | 23 | 20 | 17.6 | 35 | 27.1 |
| 24 | Troual | 2,123 | 1,698 | 0 | 23 | 20 | 39.1 | 35 | 60.2 |
| 25 | Zlayh | 176 | 141 | 127 | 23 | 20 | 3.6 | 35 | 5.5 |
| 26 | Zourak | 766 | 613 | 132 | 23 | 20 | 14.5 | 35 | 22.3 |
| 27 | Oulad Bentahar | 114 | 91 | 101 | 23 | 20 | 2.4 | 35 | 3.7 |
| 28 | Oulad Hmidou | 140 | 112 | 67 | 23 | 20 | 2.8 | 35 | 4.3 |
| 29 | Jamae El Ouad | 1,035 | 828 | 332 | 23 | 20 | 20.0 | 35 | 30.8 |
| | **Total** | **12,525** | **10,022** | **4,369** | - | - | **243.4** | - | **374.5** |

**Table 3.4.7 Water Demand in the Model Area (Teroual Commune), 2005**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Achira | 225 | 180 | 170 | 27 | 20 | 5.4 | 30 | 7.7 |
| 2 | Ain Arsa | 375 | 300 | 186 | 27 | 20 | 8.7 | 30 | 12.4 |
| 3 | Ain Haddad | 515 | 412 | 151 | 27 | 20 | 11.6 | 30 | 16.6 |
| 4 | Amalou | 193 | 154 | 62 | 27 | 20 | 4.3 | 30 | 6.1 |
| 5 | Bakkara | 343 | 274 | 168 | 27 | 20 | 7.9 | 30 | 11.3 |
| 6 | Beriat Rmel | 204 | 163 | 0 | 27 | 20 | 4.4 | 30 | 6.3 |
| 7 | Ghbalou | 1,287 | 1,029 | 1,050 | 27 | 20 | 30.9 | 30 | 44.1 |
| 8 | Glita | 322 | 257 | 224 | 27 | 20 | 7.6 | 30 | 10.9 |
| 9 | Haddarine | 407 | 326 | 219 | 27 | 20 | 9.5 | 30 | 13.6 |
| 10 | Hajar Touil | 858 | 686 | 200 | 27 | 20 | 19.1 | 30 | 27.3 |
| 11 | Houmar | 140 | 112 | 0 | 27 | 20 | 3.0 | 30 | 4.3 |
| 12 | Inghar | 64 | 51 | 95 | 27 | 20 | 1.7 | 30 | 2.4 |
| 13 | Khandak Berd | 579 | 463 | 0 | 27 | 20 | 12.5 | 30 | 17.9 |
| 14 | Koudia | 257 | 206 | 104 | 27 | 20 | 5.9 | 30 | 8.4 |
| 15 | Lalla Aicha | 118 | 94 | 69 | 27 | 20 | 2.7 | 30 | 3.9 |
| 16 | Latamna | 257 | 206 | 87 | 27 | 20 | 5.8 | 30 | 8.3 |
| 17 | Merrakine | 161 | 129 | 60 | 27 | 20 | 3.7 | 30 | 5.3 |
| 18 | Mguerouel | 375 | 300 | 190 | 27 | 20 | 8.7 | 30 | 12.4 |
| 19 | Oulad Imrane | 107 | 86 | 122 | 27 | 20 | 2.7 | 30 | 3.9 |
| 20 | Oulad Bakkal | 407 | 326 | 92 | 27 | 20 | 9.1 | 30 | 13.0 |
| 21 | Oulad Laheen | 118 | 94 | 88 | 27 | 20 | 2.8 | 30 | 4.0 |
| 22 | Remila | 182 | 146 | 133 | 27 | 20 | 4.3 | 30 | 6.1 |
| 23 | Sidi Allal Zghari | 965 | 772 | 140 | 27 | 20 | 21.3 | 30 | 30.4 |
| 24 | Troual | 2,198 | 1,758 | 0 | 27 | 20 | 47.5 | 30 | 67.9 |
| 25 | Zlayh | 182 | 146 | 127 | 27 | 20 | 4.3 | 30 | 6.1 |
| 26 | Zourak | 793 | 635 | 132 | 27 | 20 | 17.5 | 30 | 25.0 |
| 27 | Oulad Bentahar | 118 | 94 | 101 | 27 | 20 | 2.8 | 30 | 4.0 |
| 28 | Oulad Hmidou | 145 | 116 | 67 | 27 | 20 | 3.3 | 30 | 4.7 |
| 29 | Jamae El Ouad | 1,072 | 858 | 332 | 27 | 20 | 24.2 | 30 | 34.6 |
| | **Total** | **12,970** | **10,373** | **4,369** | - | - | **293.2** | - | **418.9** |

**Table 3.4.8 Water Demand in the Model Area (Teroual Commune), 2010**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Achira | 233 | 187 | 170 | 31 | 20 | 6.3 | 26 | 8.5 |
| 2 | Ain Arsa | 389 | 311 | 186 | 31 | 20 | 10.2 | 26 | 13.8 |
| 3 | Ain Haddad | 533 | 426 | 151 | 31 | 20 | 13.7 | 26 | 18.5 |
| 4 | Amalou | 200 | 160 | 62 | 31 | 20 | 5.1 | 26 | 6.9 |
| 5 | Bakkara | 355 | 284 | 168 | 31 | 20 | 9.3 | 26 | 12.6 |
| 6 | Beriat Rmel | 211 | 169 | 0 | 31 | 20 | 5.2 | 26 | 7.0 |
| 7 | Ghbalou | 1,332 | 1,066 | 1,050 | 31 | 20 | 36.2 | 26 | 48.9 |
| 8 | Glita | 333 | 266 | 224 | 31 | 20 | 8.9 | 26 | 12.0 |
| 9 | Haddarine | 422 | 338 | 219 | 31 | 20 | 11.1 | 26 | 15.0 |
| 10 | Hajar Touil | 888 | 711 | 200 | 31 | 20 | 22.6 | 26 | 30.5 |
| 11 | Houmar | 145 | 116 | 0 | 31 | 20 | 3.6 | 26 | 4.9 |
| 12 | Inghar | 67 | 53 | 95 | 31 | 20 | 1.9 | 26 | 2.6 |
| 13 | Khandak Berd | 600 | 480 | 0 | 31 | 20 | 14.9 | 26 | 20.1 |
| 14 | Koudia | 266 | 213 | 104 | 31 | 20 | 6.9 | 26 | 9.3 |
| 15 | Lalla Aicha | 122 | 98 | 69 | 31 | 20 | 3.2 | 26 | 4.3 |
| 16 | Latamna | 266 | 213 | 87 | 31 | 20 | 6.9 | 26 | 9.3 |
| 17 | Merrakine | 167 | 133 | 60 | 31 | 20 | 4.3 | 26 | 5.8 |
| 18 | Mguerouel | 389 | 311 | 190 | 31 | 20 | 10.2 | 26 | 13.8 |
| 19 | Oulad Imrane | 111 | 89 | 122 | 31 | 20 | 3.1 | 26 | 4.2 |
| 20 | Oulad Bakkal | 422 | 338 | 92 | 31 | 20 | 10.8 | 26 | 14.6 |
| 21 | Oulad Lahcen | 122 | 98 | 88 | 31 | 20 | 3.3 | 26 | 4.5 |
| 22 | Remila | 189 | 151 | 133 | 31 | 20 | 5.1 | 26 | 6.9 |
| 23 | Sidi Allal Zghari | 999 | 799 | 140 | 31 | 20 | 25.2 | 26 | 34.1 |
| 24 | Troual | 2,276 | 1,821 | 0 | 31 | 20 | 56.5 | 26 | 76.4 |
| 25 | Zlayh | 189 | 151 | 127 | 31 | 20 | 5.1 | 26 | 6.9 |
| 26 | Zourak | 822 | 657 | 132 | 31 | 20 | 20.8 | 26 | 28.1 |
| 27 | Oulad Bentahar | 122 | 98 | 101 | 31 | 20 | 3.3 | 26 | 4.5 |
| 28 | Oulad Hmidou | 150 | 120 | 67 | 31 | 20 | 3.9 | 26 | 5.3 |
| 29 | Jamae El Ouad | 1,110 | 888 | 332 | 31 | 20 | 28.5 | 26 | 38.5 |
| | Total | 13,430 | 10,745 | 4,369 | - | - | 346.1 | - | 467.7 |

## Table 3.4.9 Water Demand in the Model Area (El Bibane Commune), 1995

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Unit Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Aounane | 752 | 602 | 85 | 20 | 20 | 12.3 | 40 | 20.5 |
| 2 | Astar | 420 | 336 | 45 | 20 | 20 | 6.9 | 40 | 11.5 |
| 3 | Babet El Bir | 1,203 | 962 | 320 | 20 | 20 | 20.2 | 40 | 33.7 |
| 4 | Douehar | 287 | 230 | 47 | 20 | 20 | 4.7 | 40 | 7.8 |
| 5 | Oulad Ben Jemaa | 301 | 241 | 42 | 20 | 20 | 4.9 | 40 | 8.2 |
| 6 | Ras Lakbour | 307 | 246 | 43 | 20 | 20 | 5.0 | 40 | 8.3 |
| 7 | Rif | 303 | 242 | 91 | 20 | 20 | 5.1 | 40 | 8.5 |
| 8 | Rkiba | 1,022 | 818 | 132 | 20 | 20 | 16.8 | 40 | 28.0 |
| 9 | Tazghadra | 1,636 | 1,309 | 491 | 20 | 20 | 27.7 | 40 | 46.2 |
| 10 | Zaouia Sidi Ahmend | 280 | 224 | 52 | 20 | 20 | 4.6 | 40 | 7.7 |
| | Total | 6,511 | 5,210 | 1348 | - | - | 108.2 | - | 180.3 |

## Table 3.4.10 Water Demand in the Model Area (El Bibane Commune), 2000

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Unit Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Aounane | 779 | 623 | 85 | 23 | 20 | 14.6 | 35 | 22.5 |
| 2 | Astar | 435 | 348 | 45 | 23 | 20 | 8.1 | 35 | 12.5 |
| 3 | Babet El Bir | 1,246 | 997 | 320 | 23 | 20 | 23.9 | 35 | 36.8 |
| 4 | Douehar | 297 | 238 | 47 | 23 | 20 | 5.6 | 35 | 8.6 |
| 5 | Oulad Ben Jemaa | 312 | 249 | 42 | 23 | 20 | 5.9 | 35 | 9.1 |
| 6 | Ras Lakbour | 318 | 254 | 43 | 23 | 20 | 6.0 | 35 | 9.2 |
| 7 | Rif | 314 | 251 | 91 | 23 | 20 | 6.0 | 35 | 9.2 |
| 8 | Rkiba | 1,058 | 847 | 132 | 23 | 20 | 19.9 | 35 | 30.6 |
| 9 | Tazghadra | 1,694 | 1,355 | 491 | 23 | 20 | 32.6 | 35 | 50.2 |
| 10 | Zaouia Sidi Ahmend | 290 | 232 | 52 | 23 | 20 | 5.5 | 35 | 8.5 |
| | Total | 6,742 | 5,394 | 1348 | - | - | 128.1 | - | 197.1 |

**Table 3.4.11 Water Demand in the Model Area (El Bibane Commune), 2005**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Unit Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Aounane | 806 | 645 | 85 | 27 | 20 | 17.7 | 30 | 25.3 |
| 2 | Astar | 450 | 360 | 45 | 27 | 20 | 9.9 | 30 | 14.1 |
| 3 | Babet El Bir | 1,290 | 1,032 | 320 | 27 | 20 | 28.8 | 30 | 41.1 |
| 4 | Douehar | 308 | 246 | 47 | 27 | 20 | 6.8 | 30 | 9.7 |
| 5 | Oulad Ben Jemaa | 323 | 258 | 42 | 27 | 20 | 7.1 | 30 | 10.1 |
| 6 | Ras Lakbour | 329 | 263 | 43 | 27 | 20 | 7.2 | 30 | 10.3 |
| 7 | Rif | 325 | 260 | 91 | 27 | 20 | 7.3 | 30 | 10.4 |
| 8 | Rkiba | 1,096 | 877 | 132 | 27 | 20 | 24.1 | 30 | 34.4 |
| 9 | Tazghadra | 1,754 | 1,403 | 491 | 27 | 20 | 39.4 | 30 | 56.3 |
| 10 | Zaouia Sidi Ahmend | 300 | 240 | 52 | 27 | 20 | 6.6 | 30 | 9.4 |
| | Total | 6,981 | 5,584 | 1348 | - | - | 154.9 | - | 221.3 |

**Table 3.4.12 Water Demand in the Model Area (El Bibane Commune), 2010**

| | Name of Douar | Population | Served Popualtion (80%) | Livestock (converted to large) | Unit Water Demand | | Unit Water Demand (m3/d) | UFW (%) | Water Demand (m3/d) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Domestic (l/c/d) | Livestock (l/head/d) | | | |
| 1 | Aounane | 835 | 668 | 85 | 31 | 20 | 21.0 | 26 | 28.4 |
| 2 | Astar | 466 | 373 | 45 | 31 | 20 | 11.7 | 26 | 15.8 |
| 3 | Babet El Bir | 1,336 | 1,069 | 320 | 31 | 20 | 34.1 | 26 | 46.1 |
| 4 | Douehar | 319 | 255 | 47 | 31 | 20 | 8.0 | 26 | 10.8 |
| 5 | Oulad Ben Jemaa | 334 | 267 | 42 | 31 | 20 | 8.4 | 26 | 11.4 |
| 6 | Ras Lakbour | 341 | 273 | 43 | 31 | 20 | 8.6 | 26 | 11.6 |
| 7 | Rif | 336 | 269 | 91 | 31 | 20 | 8.6 | 26 | 11.6 |
| 8 | Rkiba | 1,135 | 908 | 132 | 31 | 20 | 28.5 | 26 | 38.5 |
| 9 | Tazghadra | 1,816 | 1,453 | 491 | 31 | 20 | 46.5 | 26 | 62.8 |
| 10 | Zaouia Sidi Ahmend | 311 | 249 | 52 | 31 | 20 | 7.9 | 26 | 10.7 |
| | Total | 7,229 | 5,784 | 1348 | - | - | 183.3 | - | 247.7 |

## Table 3.4.13 Existing Water Supply Conditions in Ain Defali

| | Douar | No. of Family Surveyed | Population Surveyed | No. of Livestock | | Water Consumption ( l/d ) | | | | Means of Transport | | | Person in charge | | | Time | | Distance to carry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Small | Large | Domestic | | | Livestock | Vehicle | Mule | Foot | Men | W'men | Child | Sum. | Wint. | |
| | | | | | | Summer | Winter | Total | Summer | (%) | | | (%) | | | (hr) | | (km) |
| 1 | Hjafna | 34 | 270 | 168 | 88 | 6,470 | 6,780 | 13,250 | 4,360 | 38 | 62 | - | 44 | 3 | 53 | 4 | 1 | 1 |
| 2 | Hjajama | 9 | 78 | 45 | 41 | 1,870 | 1,550 | 3,420 | 1,410 | - | 100 | - | 17 | 5 | 78 | 3 | 1 | 7 |
| 3 | Benizid | 7 | 70 | 233 | 27 | 775 | 775 | 1,550 | 1,765 | - | 100 | - | - | 86 | 14 | 3 | 5 | 3 |
| 4 | Ouled Salem | 10 | 84 | 105 | 51 | 775 | 775 | 1,550 | 2,565 | - | 100 | - | 50 | 10 | 40 | 5 | 2 | 7 |
| 5 | Chouker | 13 | 179 | 244 | 100 | 1,620 | 1,720 | 3,340 | 5,220 | 8 | 92 | - | 35 | - | 65 | 6 | - | 12 |
| 6 | C. Fadilia | 18 | 214 | 158 | 99 | 6,055 | 3,070 | 9,125 | 4,750 | 19 | 81 | - | 1 | - | 19 | 4 | 1 | 8 |
| 7 | Chawia Bouriatel | 15 | 178 | 215 | 106 | 3,450 | 1,830 | 5,280 | 1,900 | 6 | 94 | - | 27 | 6 | 67 | 3 | - | 10 |
| 8 | Laamama | 9 | 77 | 50 | 33 | 1,060 | 950 | 2,010 | 890 | - | 100 | - | 39 | 11 | 50 | 5 | - | 2 |
| 9 | Chawia Rmel | 22 | 171 | 138 | 59 | 2,720 | 1,780 | 4,500 | 1,210 | - | 100 | - | 27 | 9 | 64 | 2 | - | 1 |
| 10 | Slim | 57 | 471 | 426 | 198 | 10,070 | 10,070 | 20,140 | 10,050 | - | 96 | 4 | 44 | 7 | 49 | 4 | 1 | 10 |
| 11 | Ouled Boutayeb | 21 | 192 | 101 | 54 | 3,150 | 1,640 | 4,790 | - | - | 100 | - | 72 | 14 | 14 | 3 | - | 3 |
| 12 | Ain Chamia | 23 | 205 | 145 | 101 | 1,905 | 1,905 | 3,810 | 2,845 | 4 | 92 | 4 | 17 | 13 | 70 | 3 | - | 5 |
| 13 | C. Wafa | 10 | 84 | 147 | 58 | 1,045 | 1,045 | 2,090 | 3,055 | - | - | - | 9 | 24 | 67 | 2 | 1 | 1 |
| 14 | D. Ain Defali | 27 | 207 | 33 | 29 | 1,965 | 1,965 | 3,930 | 485 | - | 93 | 7 | 33 | 43 | 24 | 6 | | |
| | Total (Ave) | 275 | 2480 | 2208 | 1044 | 42,930 | 35,855 | 78,785 | 40,505 | (6) | (93) | (1) | (35) | (17) | (48) | (3.8) | (1.7) | (5.4) |
| | Unit Water (l/c/d) | | | | | (17.3) | (14.5) | | | | | | | | | | | |

Note: Livestock is occasionally supplied with water in houses during summer, and this amounts to 15% out of the total consumption.

In winter (rainy season), water is fed to livestocks outdoors.

Water consumption for livestock in winter is assumed to be equal to the one in summer.

## Table 3.4.14 Existing Water Supply Conditions in Teroual

| | Douar | No. of Family Surveyed | Population Surveyed | No. of Livestock Small | No. of Livestock Large | Water Consumption ( l/d ) Domestic Summer | Domestic Winter | Domestic Total | Livestock Summer | Means of Transport Vehicle (%) | Mule (%) | Foot (%) | Person in charge Men (%) | W'men (%) | Child (%) | Time Sum. (hr) | Wint. (hr) | Distance to carry (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | S. Allal Zeghari | 23 | 160 | 25 | 16 | 4,115 | 2,915 | 7,030 | 765 | - | 26 | 74 | - | 67 | 53 | 4 | 1 | 1 |
| 2 | Bekala | 12 | 125 | 90 | 69 | 2,910 | 2,910 | 5,820 | - | - | 92 | 8 | - | 21 | 78 | 3 | 1 | 7 |
| 3 | Khandek El Berd | 18 | 131 | 57 | 58 | 1,310 | 1,310 | 2,620 | 1,140 | - | 83 | 17 | 33 | 25 | 14 | 3 | 5 | 3 |
| 4 | Arbalou | 21 | 153 | 96 | 80 | 1,560 | 2,640 | 4,200 | 3,680 | - | 72 | 28 | 14 | 67 | 40 | 5 | 2 | 7 |
| 5 | Ain Haddad | 7 | 38 | 24 | 18 | 810 | 810 | 1,620 | 840 | - | 100 | - | 72 | 14 | 65 | 6 | - | 12 |
| 6 | Jamae El Oued | 15 | 98 | 54 | 38 | 2,275 | 2,060 | 4,335 | 1,790 | - | 100 | - | 47 | 30 | 19 | 4 | 1 | 8 |
| 7 | Ouled Bekkal | 27 | 217 | 98 | 76 | 2,145 | 1,910 | 4,055 | 1,595 | - | 89 | 11 | 20 | 34 | 67 | 1 | 4 | 10 |
| 8 | Hjar Touil | 29 | 226 | 95 | 72 | 1,905 | 2,115 | 4,020 | 890 | - | 86 | 14 | 48 | 17 | 50 | 5 | - | 2 |
| 9 | Zourak | 40 | 266 | 73 | 108 | 4,420 | 2,650 | 7,070 | - | - | 82 | 18 | 15 | 45 | 64 | 2 | - | 1 |
| | Total (Ave) | 192 | 1414 | 612 | 535 | 21,450 | 19,320 | 40,770 | 40,505 | (0) | (81) | (11) | (24) | (31) | (44) | (3.7) | (2.3) | (5.7) |
| | Unit Water (l/c/d) | | | | | (15.2) | (13.7) | | | | | | | | | | | |

Note: Livestock is occasionally supplied with water in houses during summer, and this amounts to 15% out of the total consumption.

In winter (rainy season), water is fed to livestocks outdoors.

Water consumption for livestock in winter is assumed to be equal to the one in summer.

## Table 3.4.15 Existing Water Supply Conditions in El Bibane

| | | No. of Family Surveyed | Population Surveyed | No. of Livestock | | Water Consumption ( l/d ) | | | | Means of Transport | | | Person in charge | | | Time | | Distance to carry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Small | Large | Domestic | | | Livestock | Vehicle | Mule | Foot | Men | W'men | Child | Sum. | Wint. | |
| | | | | | | Summer | Winter | Total | Summer | (%) | | | (%) | | | (hr) | | (km) |
| 1 | Babet El Bir | 15 | 91 | 23 | 33 | 1,245 | 1,280 | 2,525 | 1,435 | - | 53 | 47 | 7 | 70 | 23 | 1 | - | 0.5 |
| 2 | Douiher | 12 | 47 | 28 | 12 | 730 | 730 | 1,460 | 620 | - | 100 | - | 29 | 8 | 63 | 2 | - | 3 |
| 3 | Aster | 12 | 99 | 25 | 16 | 1,575 | 1,020 | 2,595 | 245 | - | 100 | - | 42 | - | 58 | 2 | - | 3 |
| 4 | Aounane | 8 | 45 | 10 | 9 | 710 | 540 | 1,250 | 410 | - | 100 | - | 12 | 19 | 69 | 1.5 | - | 2 |
| 5 | Jamae Rif | 5 | 31 | 2 | 10 | 670 | 460 | 1,130 | 410 | - | 100 | - | - | 20 | 80 | 1.5 | - | 3 |
| 6 | Rkiba | 13 | 96 | 13 | 18 | 1,585 | 1,100 | 2,685 | 785 | - | 100 | - | 23 | 12 | 65 | 1.5 | - | 3 |
| 7 | Ras Lekbour | 7 | 41 | 3 | 10 | 645 | 500 | 1,145 | 415 | - | 100 | - | 7 | 14 | 79 | 1.5 | - | 2 |
| 8 | Ouled B. Jamae | 11 | 88 | 14 | 17 | 1,430 | 1,040 | 2,470 | 750 | - | - | 100 | - | 35 | 65 | 0.5 | - | 0.5 |
| 9 | Zaouia | 11 | 78 | 39 | 18 | 965 | 660 | 1,625 | 555 | - | 64 | 36 | 27 | 36 | 37 | 1 | - | 0.5 |
| 10 | Tazerharda | 11 | 77 | 60 | 36 | 2,160 | 1,880 | 4,040 | - | - | 73 | 27 | 18 | 9 | 73 | 0.5 | - | 0.5 |
| | Total (Ave) | 105 | 693 | 217 | 179 | 11,715 | 9,210 | 20,925 | 40,505 | (0) | (79) | (21) | (17) | (22) | (61) | (1.3) | - | (1.8) |
| | Unit Water(l/c/d) | | | | | (16.9) | (13.3) | | | | | | | | | | | |

Note: Livestock is occasionally supplied with water in houses during summer, and this amounts to 15% out of the total consumption.

In winter (rainy season), water is fed to livestocks outdoors.

Water consumption for livestock in winter is assumed to be equal to the one in summer.

## Table 3.6.3 Unit Costs for Major Construction Items (1/2)

| Cost items | Unit | Total (DH) | FC (US$) | LC (DH) |
|---|---|---|---|---|
| < Macro Basis Unit Costs > | | | | |
| **Procurement cost, CIF site** | | | | |
| - Deepwell pump & motor, 150 l/min., 3.7 kw, head 60 m, 40 mm dia., 12-stage | set | 120360 | 12600 | 12000 |
| - Deepwell pump & motor, 110 l/min. 11 kw, head 210 m, 40 mm dia., 19-stage | set | 132400 | 14000 | 12000 |
| - Deepwell pump & motor, 50 l/min. 1.5 kw, head 60 m, 40 mm dia., 12-stage | set | 47300 | 5000 | 4300 |
| - Distribution pump & motor, 5.5 kw 40 mm dia. | set | 47800 | 5000 | 4800 |
| - Distribution pump & motor, 3.7 kw 40 mm dia. | set | 34460 | 3600 | 3500 |
| - Distribution pump & motor, 2.2 kw 40 mm dia. | set | 23900 | 2500 | 2400 |
| - Distribution pump & motor, 1.5 kw 40 mm dia. | set | 22080 | 2300 | 2300 |
| - Diesel generator, 10 kVA | set | 55000 | 5800 | 6000 |
| - Diesel generator, 30 kVA | set | 154000 | 16100 | 15000 |
| **Construction costs** | | | | |
| - Well development and pumping test | 8-hr | 4800 | 419 | 1120 |
| - Well recharge | 8-hr | 3200 | 279 | 800 |
| - Well logging | unit | 112000 | 9767 | 28000 |
| - pumping station | | | | |
| 1) electro-mechanical cost, C=75 %- | - | ( C=162.549 * P 0.507 , P=Power, kw) | | |
| 2) pump house | m2 | 6500 | 567 | 1625 |
| - Water treatment plant including primary sedimentation and tank settling, 50 l/s | lot | 36700000 | 3200580 | 9175000 |
| - Water reservoir, semi-burried, 100 m3 | place | 302000 | 26337 | 75500 |
| - Water reservoir, semi-burried, 200 m3 | place | 524000 | 45698 | 131000 |
| - Power line, 22 kV/380 V/50 Hz | km | 240000 | 20930 | 60000 |
| - Access road, w=4.0 m, asphalt pavement | km | 625000 | 54506 | 156250 |
| **Operation and maintenance costs** | | | | |
| - Operation cost of pumping station (medium scale) | year | 180000 | - | 180000 |
| - Maintenance cost of : | | | | |
| 1) drilled well | year | ( 2.5 % of investment cost ) | | |
| 2) dughole | year | ( 1.0 % of investment cost ) | | |
| 3) equipment of well or dughole | year | ( 3.0 % of investment cost ) | | |
| 4) electro-mech. equipment for pumping station | year | ( 3.0 % of investment cost ) | | |
| 5) electro-mech. equipment for water treatment plant | year | ( 3.0 % of investment cost ) | | |
| 6) water reservoir | year | ( 0.5 % of investment cost ) | | |
| 7) pipes | year | ( 0.5 % of investment cost ) | | |
| 8) fittings and valves | year | ( 1.0 % of investment cost 0 | | |
| 9) electric and telephone lines | year | ( 1.0 % of investment cost ) | | |
| 10) access road | year | ( 3.0 % 0f investment cost ) | | |

## Table 3.6.3 Unit Costs for Major Construction Items (2/2)

| Cost items | Unit | Total (DH) | FC (US$) | LC (DH) |
|---|---|---|---|---|
| < Unit Construction Cost Basis > | | | | |
| **Civil works** | | | | |
| 1) Bulk excavation, common | cu.m | 30 | 2.5 | 8.5 |
| 2) Trench excavation , rock | cu.m | 100 | 8.7 | 25 |
| 3) Backfill of trench | cu.m | 28 | 2.4 | 7 |
| 4) Plain concrete for thrust blocks and anchors (supply placing & including formwork, re-bar and all necessary works ), 150 kg/m3 | cu.m | 650 | 56.7 | 163 |
| 5) Foundation concrete (supply placing & including formwork, re-bar and all necessary works ), 250 kg/m3 | cu.m | 1000 | 87.2 | 250 |
| 6) Masonry work in foundation | cu.m | 300 | 26.2 | 75 |
| 7) Formwork for concrete | sq.m | 66 | 5.8 | 17 |
| 8) Brickwork | sq.m | 150 | 13.1 | 38 |
| **Plumbing** | | | | |
| 1) Asbestos cement pipe class 10, dia. 100 mm | lin.m | 230 | 20.1 | 58 |
| 2) Ductile iron pipe, dia. 100 mm | lin.m | 530 | 46.2 | 133 |
| 3) Concrete pipe, dia. 100 mm | lin.m | 125 | 10.9 | 31 |
| 4) Galvanized steel pipe, 125 mm | lin.m | 310 | 32 | 34 |
| 5) Galvanized steel pipe, 89 mm | lin.m | 241 | 25 | 26 |
| 6) Galvanized steel pipe, 75 mm | lin.m | 210 | 22 | 20 |
| 7) PVC pipe, dia. 75 mm | lin.m | 150 | 13.1 | 38 |
| 8) Gate valve, dia 100 mm | unit | 18500 | 1613.4 | 4625 |
| 9) Gate valve for service connection dia. 20 mm | unit | 480 | 41.9 | 120 |
| 10) Isolation valve, dia. 20 mm | unit | 180 | 15.7 | 45 |
| 11) Stop valve, 40 mm | unit | 179 | 15.6 | 45 |
| **Electric work** | | | | |
| 1) Cable 4, 1000 R, 4 * 10 mm2 | lin.m | 92 | 8 | 23 |
| 2) Distribution box | unit | 3886 | 338.9 | 972 |
| 3) Circuit breaker, 10 to 30 amps | unit | 1030 | 89.8 | 258 |
| **Painting** | | | | |
| 1) Vinyl painting | sq.m | 26 | 2.3 | 7 |
| 2) Wood painting | sq.m | 32 | 2.8 | 8 |

## Table 3.6.7 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas
### ( Supply Area by gravity, 1/5 )

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| **Construction of facilities** | | | | | | | |
| mobilization & preparatory works, approx. 3 % of total construction & rehabilitation costs excluding T.V.A | LS | - | - | 140956 | - | 251049 | 1463269 |
| **< Ain Defali >** | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 11.0 kw head 48 m, 80 mm dia., 5-stage, 0.69 m3/min. w/accessaries | set | 3 | 29520 | 88560 | 28208 | 84624 | 846240 |
| connection tank, RC ,50 m3 | set | 1 | 14202 | 14202 | 41040 | 41040 | 163177 |
| connection pump, SV-JA Type, 15.0 kw 1.38 m3/min. * 35 m w/accessaries | set | 2 | 30240 | 60480 | 28896 | 57792 | 577920 |
| strainer | set | 3 | 450 | 1350 | 430 | 1290 | 12900 |
| frange and valve | set | 3 | 450 | 1350 | 430 | 1290 | 12900 |
| control panel and cable | set | 3 | 2700 | 8100 | 2580 | 7740 | 77400 |
| galvanized steel pipe, 150 mm dia.,feeder main | m | 760 | 35 | 26600 | 38 | 28880 | 257640 |
| galvanized steel pipe, 125 mm dia., feeder main | m | 530 | 32 | 16960 | 34 | 18020 | 163876 |
| water level sensor | set | 3 | 1100 | 3300 | 860 | 2580 | 30960 |
| fittings, 10 % of feeder main | LS | - | - | 4356 | - | 4690 | 42152 |
| civil and installation works, 25 % of above | LS | - | - | 56315 | - | 61987 | 546291 |
| miscellaneous works, 5 % of above | LS | - | - | 14079 | - | 15497 | 136573 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C. 600 m3 | set | 1 | 120000 | 120000 | 346400 | 346400 | 1378400 |
| (3) Distribution pipe ( supply, install., and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 200 mm | lin.m | 600 | 40 | 24000 | 42 | 25200 | 231600 |
| distribution pipe, galvanized steel, 150 mm | lin.m | 1500 | 35 | 52500 | 37 | 55500 | 507000 |
| distribution pipe, galvanized steel, 125 mm | lin.m | 4700 | 32 | 150400 | 34 | 159800 | 1453240 |
| distribution pipe, galvanized steel, 100 mm | lin.m | 13600 | 28 | 380800 | 30 | 408000 | 3682880 |
| distribution pipe, galvanized steel, 89 mm | lin.m | 11750 | 25 | 293750 | 26 | 305500 | 2831750 |
| distribution pipe, galvanized steel, 75 mm | lin.m | 12530 | 22 | 275660 | 20 | 250600 | 2621276 |
| fittings, 30 % of above | LS | - | - | 353133 | - | 361380 | 3398324 |

## Table 3.6.7 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas
### ( Supply Area by gravity, 2/5 )

US$ 1.0 = DH 8.6 = Y 100 (Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| (4) Distribution tank | | | | | | | |
| distribution tank, R.C, V= 600 m3 | set | 1 | 120000 | 120000 | 346400 | 346400 | 1378400 |
| distribution tank, R.C, V= 400 m3 | set | 1 | 84000 | 84000 | 242480 | 242480 | 964880 |
| distribution tank, R.C, V= 100 m3 | set | 6 | 26000 | 156000 | 75240 | 451440 | 1793040 |
| (5) Stand pipe | | | | | | | |
| stand pipe, R.C, 42 m2/place | place | 25 | 10500 | 262500 | 30000 | 750000 | 3007500 |
| (6) Testing and disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |
| (7) Related facilities | | | | | | | |
| extension of electric cable | km | 15 | 4180 | 62700 | 12000 | 180000 | 719220 |
| permanent access road, W=4 m, asphalt | km | 3 | 54500 | 163500 | 156000 | 468000 | 1874100 |
| sub total of Ain Defali | | | | 2797294 | | 4678709 | 28735439 |
| < Teroual > | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 5.5 kw head 46 m, 65 mm dia., 10-stage, 0.33 m3/min. w/accessaries | set | 2 | 23040 | 46080 | 22010 | 44020 | 440308 |
| connection tank, R.C 25 m3 | set | 1 | 7101 | 7101 | 20520 | 20520 | 81589 |
| connection pump, MV-JA Type, 45 kw 185 m * 65 mm , 0.66 m3/min. | set | 2 | 48960 | 97920 | 46800 | 93600 | 935712 |
| strainer | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| galvanized steel pipe, 125 mm dia., feeder main | m | 630 | 32 | 20160 | 34 | 21420 | 194796 |
| galvanized steel pipe, 75 mm dia., feeder main | m | 230 | 22 | 5060 | 20 | 4600 | 48116 |
| frange and valve | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| control panel and cable | set | 2 | 2700 | 5400 | 2580 | 5160 | 51600 |
| water level sensor | set | 2 | 1100 | 2200 | 860 | 1720 | 20640 |

**Table 3.6.7 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas**
**( Supply Area by gravity, 3/5 )**

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| fittings, 10 % of feeder main | LS | - | - | 2522 | - | 2602 | 24291 |
| civil & install. works, 25 % of above | LS | - | - | 47061 | - | 48841 | 453563 |
| miscellaneous works, 5 % of above | LS | - | - | 11765 | - | 12210 | 113391 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C, 280 m3 | set | 1 | 60000 | 60000 | 170000 | 170000 | 686000 |
| (3) Distribution pipe ( supply, install., and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 125 mm | lin.m | 500 | 32 | 16000 | 34 | 17000 | 154600 |
| distribution pipe, galvanized steel, 100 mm | lin.m | 250 | 28 | 7000 | 30 | 7500 | 67700 |
| distribution pipe, galvanized steel, 89 mm | lin.m | 11300 | 25 | 282500 | 26 | 293800 | 2723300 |
| fittings, 30 % of above | LS | - | - | 91650 | - | 95490 | 883680 |
| (4) Distribution tank | | | | | | | |
| distribution tank , R.C, 280 m3 | set | 1 | 60000 | 60000 | 170000 | 170000 | 686000 |
| distribution tank , R.C, 140 m3 | set | 2 | 36000 | 72000 | 105000 | 210000 | 829200 |
| (5) Stand pipe | | | | | | | |
| stand pipe, R.C, 42 m2/place | place | 9 | 10500 | 94500 | 30000 | 270000 | 1082700 |
| (6) Testing and disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |
| (7) Related facilities | | | | | | | |
| extension of electric cable | km | 20 | 4180 | 83600 | 12000 | 240000 | 958960 |
| permanent access road | km | 0.5 | 54500 | 27250 | 156000 | 78000 | 312350 |
| sub total of Troual | | | | 1044269 | | 1810783 | 10791495 |
| **< Ain Berda >** | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 5.5 kw head 65 m, 50 mm dia., 10-stage, 0.18 m3/min. | set | 2 | 22680 | 45360 | 21672 | 43344 | 433440 |
| frange and valve | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| control panel and cable | set | 2 | 2700 | 5400 | 2580 | 5160 | 51600 |
| galvanized steel pipe, 100 mm dia. feeder main | m | 230 | 28 | 6440 | 30 | 6900 | 62284 |
| galvanized steel pipe, 75 mm dia. feeder main | m | 430 | 22 | 9460 | 20 | 8600 | 89956 |

## Table 3.6.7 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by gravity, 4/5 )

US$ 1.0 = DH 8.6 = Y 100 (Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| water level sensor | set | 2 | 1100 | 2200 | 860 | 1720 | 20640 |
| fittings, 10 % of discharge & feeder main | LS | - | - | 1590 | - | 1550 | 15224 |
| civil & install., works, 25 % of above | LS | - | - | 17838 | - | 17034 | 170436 |
| miscellaneous works, 5 % of above | LS | - | - | 4459 | - | 4258 | 42609 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C, 120 m3 | set | 1 | 31560 | 31560 | 91200 | 91200 | 362616 |
| (3) Distribution pipe ( supply, install., and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 75 mm | lin.m | 900 | 22 | 19800 | 20 | 18000 | 188280 |
| distribution pipe, galvanized steel, 64 mm | lin.m | 1300 | 20 | | 18 | | |
| distribution pipe, galvanized steel, 50 mm | lin.m | 4800 | 17 | 81600 | 16 | 76800 | 778560 |
| distribution pipe, galvanized steel, 25 mm | lin.m | 4100 | 12 | 49200 | 10 | 41000 | 464120 |
| fittings, 30 % of pipe | LS | - | - | 45180 | - | 40740 | 429288 |
| (4) Distribution tank | | | | | | | |
| distribution tank, R.C, V= 120 m3 | set | 1 | 31200 | 31200 | 90300 | 90300 | 358620 |
| distribution tank, R.C, V= 30 m3 | set | 1 | 7890 | 7890 | 22800 | 22800 | 90654 |
| distribution tank, R.C, V= 10 m3 | set | 1 | 2630 | 2630 | 7600 | 7600 | 30218 |
| (6) Stand pipe | | | | | | | |
| stand pipe, R.C, 42 m2/place | place | 4 | 10500 | 42000 | 30000 | 120000 | 481200 |
| (7) Testing & disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |
| (8) Related facilities | | | | | | | |
| extension of electric cable | km | 2 | 4180 | 8360 | 12000 | 24000 | 95896 |
| permanent access road | km | 5 | 54500 | 272500 | 156000 | 780000 | 3123500 |
| sub total, Ain Berda | | | | 688267 | | 1404446 | 7323541 |
| Total of A ( Ain Defali +Troual + Ain Bera ) | | | | 4529830 | | 7893938 | 46850475 |

**Table 3.6.7 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by gravity, 5/5 )**

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| **Rehabilitation of facilities** | | | | | | | |
| **< Ain Defali >** | | | | | | | |
| Dug hole | place | 7 | 2100 | 14700 | 5700 | 39900 | 166320 |
| Spring | place | 19 | 3100 | 58900 | 8750 | 166250 | 672790 |
| sub total | | | | 73600 | | 206150 | 839110 |
| **< Teroual >** | | | | | | | |
| Dug hole | place | 1 | 2100 | 2100 | 5700 | 5700 | 23760 |
| Spring | place | 23 | 3100 | 71300 | 8750 | 201250 | 814430 |
| sub total | | | | 73400 | | 206950 | 838190 |
| **< Ain Berda >** | | | | | | | |
| Spring | place | 7 | 3100 | 21700 | 8750 | 61250 | 247870 |
| sub total | | | | 21700 | | 61250 | 247870 |
| Total for rehabilitation | | | | 168700 | | 474350 | 1925170 |
| Total of construction and rehabilitation | | | | 4698530 | | 8368288 | 48775645 |
| Total of construction and rehabilitation including mobilization and temporary works | | | | 4839486 | | 8619336 | 50238914 |
| Value Added Tax ( VAT ) 14.0 % | | | | 0 | | 7033448 | 7033448 |
| **Grand Total** | | | | 4839486 | | 15652784 | 57272362 |

## Table 3.6.8 Disbursement Schedule
## ( Supply Area by Gravity )

Unit : 1000
US$ 1.0 = DH 8.6 = Y 100.0

| No. | Cost items | Total | | 19 96 | | 19 97 | | 19 98 | |
|---|---|---|---|---|---|---|---|---|---|
| | | FC (US$) | LC (DH) | F.C (US$) | LC (DH) | FC (US$) | LC (DH) | FC (US$) | LC (DH) |
| 1 | Direct construction cost <1 | 4839 | 15653 | 0 | 0 | 2420 | 7827 | 2420 | 7827 |
| 2 | Land acquisition & compensation costs <2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | Administration expenses <3 | 0 | 5727 | 0 | 1145 | 0 | 2863 | 0 | 1718 |
| 4 | Engineering srvices expenses <4 | 932 | 3436 | 280 | 1031 | 466 | 1718 | 186 | 687 |
| | Total as base cost | 5771 | 24816 | 280 | 2176 | 2886 | 12408 | 2606 | 10232 |
| 5 | Price contingency <5 | 411 | 3618 | 8 | 131 | 170 | 1534 | 233 | 1954 |
| 6 | Physical contingency <6 | 927 | 4265 | 43 | 346 | 458 | 2091 | 426 | 1828 |
| | Project cost | 7110 | 32700 | 331 | 2653 | 3514 | 16033 | 3265 | 14014 |

Note <1 : Including Value Added Tax of 14.0 % in local currency portion
<2 : No account, the land owned by each commune
<3 : 10 % of total direct construction cost
<4 : 20 % of total direct construction cost for basic design, detailed design and construction supervision, and 70 % for FC and 30 % for LC
<5 : 2.9 % and 6.0 % p.a. for foreign and local currency portion respectively
<6 : 15 % of base cost with price contingency

## Table 3.6.10 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by Gravity+Pumping, 1/5)

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| **Construction of facilities** | | | | | | | |
| mobilization & preparatory works, approx. 3 % of total construction & rehabilitation costs excluding T.V.A | LS | - | - | 186448 | - | 310696 | 1914148 |
| **< Ain Defali >** | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 11.0 kw head 48 m, 80 mm dia., 5-stage, 0.69 m3/min. w/accessaries | set | 3 | 29520 | 88560 | 28208 | 84624 | 846240 |
| connection tank, RC ,50 m3 | set | 1 | 14202 | 14202 | 41040 | 41040 | 163177 |
| connection pump, SV-JA Type, 15.0 kw 1.38 m3/min. * 35 m w/accessaries | set | 2 | 30240 | 60480 | 28896 | 57792 | 577920 |
| strainer | set | 3 | 450 | 1350 | 430 | 1290 | 12900 |
| frange and valve | set | 3 | 450 | 1350 | 430 | 1290 | 12900 |
| control panel and cable | set | 3 | 2700 | 8100 | 2580 | 7740 | 77400 |
| galvanized steel pipe, 150 mm dia.,feeder main | m | 760 | 35 | 26600 | 38 | 28880 | 257640 |
| galvanized steel pipe, 125 mm dia., feeder main | m | 530 | 32 | 16960 | 34 | 18020 | 163876 |
| water level sensor | set | 3 | 1100 | 3300 | 860 | 2580 | 30960 |
| fittings, 10 % of feeder main | LS | - | - | 4356 | - | 4690 | 42152 |
| civil and installation works, 25 % of above | LS | - | - | 56315 | - | 61987 | 546291 |
| miscellaneous works, 5 % of above | LS | - | - | 14079 | - | 15497 | 136573 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C, 600 m3 | set | 1 | 120000 | 120000 | 346400 | 346400 | 1378400 |
| (3) Distribution pipe ( supply, install , and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 200 mm | lin.m | 600 | 40 | 24000 | 42 | 25200 | 231600 |
| distribution pipe, galvanized steel, 150 mm | lin.m | 1500 | 35 | 52500 | 37 | 55500 | 507000 |
| distribution pipe, galvanized steel, 125 mm | lin.m | 5500 | 32 | 176000 | 34 | 187000 | 1700600 |
| distribution pipe, galvanized steel, 100 mm | lin.m | 21400 | 28 | 599200 | 30 | 642000 | 5795120 |
| distribution pipe, galvanized steel, 89 mm | lin.m | 18050 | 25 | 451250 | 26 | 469300 | 4350050 |
| distribution pipe, galvanized steel, 75 mm | lin.m | 12530 | 22 | 275660 | 20 | 250600 | 2621276 |
| fittings, 30 % of above | LS | - | - | 473583 | - | 488880 | 4561694 |

## Table 3.6.10 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by Gravity+Pumping, 2/5 )

US$ 1.0 = DH 8.6 = Y 100 (Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| (4) Distribution tank | | | | | | | |
| distribution tank, R.C. V= 600 m3 | set | 1 | 120000 | 120000 | 346400 | 346400 | 1378400 |
| distribution tank, R.C. V= 400 m3 | set | 1 | 84000 | 84000 | 242480 | 242480 | 964880 |
| distribution tank, R.C. V= 100 m3 | set | 8 | 26000 | 208000 | 75240 | 601920 | 2390720 |
| (5) Stand pipe | | | | | | | |
| stand pipe, R.C. 42 m2/place | place | 30 | 10500 | 315000 | 30000 | 900000 | 3609000 |
| (6) pumping facilities | | | | | | | |
| distribution pump, h=100 m, Q=3.8 l/s, 18.5 kw including ancillaries and installation cost | set | 4 | 54400 | 217600 | 52000 | 208000 | 2079360 |
| distribution pump, h=13 m, Q=1.9 l/s, 1.5 kw Including ancillaries and installation cost | set | 2 | 3500 | 7000 | 3450 | 6900 | 67100 |
| (7) Testing and disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |
| (8) Related facilities | | | | | | | |
| extension of electric cable | km | 15 | 4180 | 62700 | 12000 | 180000 | 719220 |
| permanent access road, W=4 m, asphalt | km | 3 | 54500 | 163500 | 156000 | 468000 | 1874100 |
| sub total of Ain Defali | | | | 3648344 | | 5746589 | 37122349 |
| < Teroual > | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 5.5 kw head 46 m, 65 mm dia., 10-stage, 0.33 m3/min. w/accessaries | set | 2 | 23040 | 46080 | 22010 | 44020 | 440308 |
| connection tank, R.C 25 m3 | set | 1 | 7101 | 7101 | 20520 | 20520 | 81589 |
| connection pump, MV-JA Type, 45 kw 185 m * 65 mm , 0.66 m3/min. | set | 2 | 48960 | 97920 | 46800 | 93600 | 935712 |
| strainer | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| galvanized steel pipe, 125 mm dia., feeder main | m | 630 | 32 | 20160 | 34 | 21420 | 194796 |
| galvanized steel pipe, 75 mm dia., feeder main | m | 230 | 22 | 5060 | 20 | 4600 | 48116 |
| frange and valve | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| control panel and cable | set | 2 | 2700 | 5400 | 2580 | 5160 | 51600 |
| water level sensor | set | 2 | 1100 | 2200 | 860 | 1720 | 20640 |

**Table 3.6.10 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas**
**( Supply Area by Gravity+Pumping, 3/5 )**

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| fittings, 10 % of feeder main | LS | - | - | 2522 | - | 2602 | 24291 |
| civil & install. works, 25 % of above | LS | - | - | 47061 | - | 48841 | 453563 |
| miscellaneous works, 5 % of above | LS | - | - | 11765 | - | 12210 | 113391 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C. 280 m3 | set | 1 | 60000 | 60000 | 170000 | 170000 | 686000 |
| (3) Distribution pipe ( supply, install., and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 125 mm | lin.m | 500 | 32 | 16000 | 34 | 17000 | 154600 |
| distribution pipe, galvanized steel, 100 mm | lin.m | 250 | 28 | 7000 | 30 | 7500 | 67700 |
| distribution pipe, galvanized steel, 89 mm | lin.m | 20000 | 25 | 500000 | 26 | 520000 | 4820000 |
| fittings, 30 % of above | LS | - | - | 156900 | - | 163350 | 1512690 |
| (4) Distribution tank | | | | | | | |
| distribution tank , R.C. 280 m3 | set | 1 | 60000 | 60000 | 170000 | 170000 | 686000 |
| distribution tank , R.C. 140 m3 | set | 4 | 36000 | 144000 | 105000 | 420000 | 1658400 |
| (5) Stand pipe | | | | | | | |
| stand pipe, R.C. 42 m2/place | place | 15 | 10500 | 157500 | 30000 | 450000 | 1804500 |
| (6) distribution pump | | | | | | | |
| distribution pump, h=130 m, Q=2.7 l/s, 30 kw including ancillaries and installaton | set | 4 | 51400 | 205600 | 49000 | 196000 | 1964160 |
| distribution pump, h=70 m, Q=2.7 l/s, 7.5 kw including ancillaries and installaton | set | 2 | 10500 | 21000 | 10080 | 20160 | 200760 |
| distribution pump, h=60 m, Q=2.7 l/s, 7.5 kw including ancillaries and installaton | set | 2 | 10500 | 21000 | 10080 | 20160 | 200760 |
| (7) Testing and disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |
| (8) Related facilities | | | | | | | |
| extension of electric cable | km | 20 | 4180 | 83600 | 12000 | 240000 | 958960 |
| permanent access road | km | 0.5 | 54500 | 27250 | 156000 | 78000 | 312350 |
| sub total of Troual | | | | 1709619 | | 2731163 | 17433885 |

## Table 3.6.10 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by Gravity+Pumping, 4/5)

US$ 1.0 = DH 8.6 = Y 100 (Jan., 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| **< Ain Berda >** | | | | | | | |
| (1) Well site facilities | | | | | | | |
| well pump and motor, BS-MF Type, 5.5 kw head 65 m, 50 mm dia., 10-stage, 0.18 m3/min. | set | 2 | 22680 | 45360 | 21672 | 43344 | 433440 |
| frange and valve | set | 2 | 450 | 900 | 430 | 860 | 8600 |
| control panel and cable | set | 2 | 2700 | 5400 | 2580 | 5160 | 51600 |
| galvanized steel pipe, 100 mm dia. feeder main | m | 230 | 28 | 6440 | 30 | 6900 | 62284 |
| galvanized steel pipe, 75 mm dia. feeder main | m | 430 | 22 | 9460 | 20 | 8600 | 89956 |
| water level sensor | set | 2 | 1100 | 2200 | 860 | 1720 | 20640 |
| fittings, 10 % of discharge & feeder main | LS | - | - | 1590 | - | 1550 | 15224 |
| civil & install., works, 25 % of above | LS | - | - | 17838 | - | 17034 | 170436 |
| miscellaneous works, 5 % of above | LS | - | - | 4459 | - | 4258 | 42609 |
| (2) Main distribution tank | | | | | | | |
| main distribution tank , R.C. 120 m3 | set | 1 | 31560 | 31560 | 91200 | 91200 | 362616 |
| (3) Distribution pipe ( supply, install., and joints ) | | | | | | | |
| distribution pipe, galvanized steel, 75 mm | lin.m | 900 | 22 | 19800 | 20 | 18000 | 188280 |
| distribution pipe, galvanized steel, 64 mm | lin.m | 1300 | 20 | | 18 | | |
| distribution pipe, galvanized steel, 50 mm | lin.m | 4800 | 17 | 81600 | 16 | 76800 | 778560 |
| distribution pipe, galvanized steel, 25 mm | lin.m | 4100 | 12 | 49200 | 10 | 41000 | 464120 |
| fittings, 30 % of pipe | LS | - | - | 45180 | - | 40740 | 429288 |
| (4) Distribution tank | | | | | | | |
| distribution tank, R.C, V= 120 m3 | set | 1 | 31200 | 31200 | 90300 | 90300 | 358620 |
| distribution tank, R.C, V= 30 m3 | set | 1 | 7890 | 7890 | 22800 | 22800 | 90654 |
| distribution tank, R.C, V= 10 m3 | set | 1 | 2630 | 2630 | 7600 | 7600 | 30218 |
| (6) Stand pipe | | | | | | | |
| stand pipe, R.C. 42 m2/place | place | 4 | 10500 | 42000 | 30000 | 120000 | 481200 |
| (7) Testing & disinfection | | | | | | | |
| testing and disinfection | LS | - | - | 2700 | - | 2580 | 25800 |

**Table 3.6.10 Priced Bill of Quantities for Construction and Rehabilitation Works in Model Areas ( Supply Area by Gravity+Pumping, 5/5 )**

US$ 1.0 = DH 8.6 = Y 100 ( Jan. 1996)

| Work items | Unit | Q'ty | FC portion Unit (US$) | FC portion Amount (US$) | LC portion Unit (DH) | LC portion Amount (DH) | Total equivalent (DH) |
|---|---|---|---|---|---|---|---|
| (8) Related facilities | | | | | | | |
| extension of electric cable | km | 2 | 4180 | 8360 | 12000 | 24000 | 95896 |
| permanent access road | km | 5 | 54500 | 272500 | 156000 | 780000 | 3123500 |
| sub total, Ain Berda | | | | 688267 | | 1404446 | 7323541 |
| Total of A ( Ain Defali +Troual + Ain Bera ) | | | | 6046230 | | 9882198 | 61879775 |
| **Rehabilitation of facilities** | | | | | | | |
| **< Ain Defali >** | | | | | | | |
| Dug hole | place | 7 | 2100 | 14700 | 5700 | 39900 | 166320 |
| Spring | place | 19 | 3100 | 58900 | 8750 | 166250 | 672790 |
| sub total | | | | 73600 | | 206150 | 839110 |
| **< Teroual >** | | | | | | | |
| Dug hole | place | 1 | 2100 | 2100 | 5700 | 5700 | 23760 |
| Spring | place | 23 | 3100 | 71300 | 8750 | 201250 | 814430 |
| sub total | | | | 73400 | | 206950 | 838190 |
| **< Ain Berda >** | | | | | | | |
| Spring | place | 7 | 3100 | 21700 | 8750 | 61250 | 247870 |
| sub total | | | | 21700 | | 61250 | 247870 |
| Total for rehabilitation | | | | 168700 | | 474350 | 1925170 |
| Total of construction and rehabilitation | | | | 6214930 | | 10356548 | 63804945 |
| Total of construction and rehabilitation including mobilization and temporary works | | | | 6401378 | | 10667244 | 65719093 |
| Value Added Tax ( VAT ) 14.0 % | | | | 0 | | 9200673 | 9200673 |
| **Grand Total** | | | | 6401378 | | 19867917 | 74919767 |

## Table 3.6.11 Disbursement Schedule
## ( Supply Area by Gravity+Pumping )

Unit : 1000
US$ 1.0 = DH 8.6 = Y 100.0

| Cost items | Total | | 19 96 | | 19 97 | | 19 98 | |
|---|---|---|---|---|---|---|---|---|
| | FC (US$) | LC (DH) | F.C (US$) | LC (DH) | FC (US$) | LC (DH) | FC (US$) | LC (DH) |
| Direct construction cost <1 | 6401 | 19868 | 0 | 0 | 3201 | 9934 | 3201 | 9934 |
| Land acquisition & compensation costs <2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Administration expenses <3 | 0 | 7492 | 0 | 1498 | 0 | 3746 | 0 | 2247 |
| Engineering srvices expenses <4 | 1220 | 4495 | 366 | 1348 | 610 | 2247 | 244 | 899 |
| Total as base cost | 7621 | 31855 | 366 | 2847 | 3810 | 15927 | 3444 | 13080 |
| Price contingency <5 | 543 | 4638 | 11 | 171 | 224 | 1969 | 308 | 2498 |
| Physical contingency <6 | 1225 | 5474 | 56 | 453 | 605 | 2684 | 563 | 2337 |
| Project cost | 9388 | 41966 | 433 | 3470 | 4639 | 20580 | 4316 | 17916 |

Note <1 : Including Value Added Tax of 14.0 % in local currency portion
<2 : No account, the land owned by each commune
<3 : 10 % of total direct construction cost
<4 : 20 % of total direct construction cost for basic design, detailed design and construction supervision, and 70 % for FC and 30 % for LC
<5 : 2.9 % and 6.0 % p.a. for foreign and local currency portion respectively
<6 : 15 % of base cost with price contingency

## Table 3.6.12 Annual Operation Cost for Model Areas
## ( Supply Area by Gravity )

| Model area | Cost items | Facilities | Unit | Q'ty | Unit cost ( DH ) | Amount ( DH ) | Total Annual Operation cost ( DH ) |
|---|---|---|---|---|---|---|---|
| Ain Defali | Electric charge | 1) well pump, 11 kw*3 sets | kwh | 114048 | 0.8 | 91238 | |
| | | 2) connection pump, 15kw * 2 | kwh | 103680 | 0.8 | 82944 | |
| | Operator charge | | m/m | 12 | 4000 | 48000 | |
| | Total | | | | | | 222182 |
| Teroual | Electric charge | 1) well pump, 5.5kw*2 sets | kwh | 38016 | 0.8 | 30413 | |
| | | 2) connection pump, 45 kw * 2 | kwh | 311040 | 0.8 | 248832 | |
| | Operator charge | | m/m | 24 | 4000 | 96000 | |
| | Total | | | | | | 375245 |
| Ain Berda | Electric charge | 1) well pump, 5.5kw*2 sets | kwh | 38016 | 0.8 | 30413 | |
| | Operator charge | | m/m | 12 | 4000 | 48000 | |
| | Total | | | | | | 78413 |
| | Total, 3 model areas | | | | | | 675840 |

Conditions
1) operate by 80 % of rated output
2) annual operation hour is 4320 hour / unit ( 12 hr/day * 30 d/m * 12 m/y )

## Table 3.6.13 Annual Maintenance Cost for Model Areas
## ( Supply Area by Gravity )

| Model Area | Facilities | Unit | Q'ty | Investment Cost | Annual Maintenance Cost: Ratio to Investment Cost | Annual Maintenance Cost: Cost | Total Annual Maintenance Cost |
|---|---|---|---|---|---|---|---|
| | | | | ( DH ) | ( % ) | ( DH/Year ) | ( DH/Year ) |
| Ain Defali | New constructed facilities | | | | | | |
| | 01) well | set | 3 | 900000 | 2.5 | 22500 | |
| | 02) equipment for well | set | 5 | 1424160 | 3.0 | 42725 | |
| | 03) main feeder pipe | m | 1290 | 421516 | 0.5 | 2108 | |
| | 04) fittings & valves for 2) & 3) | LS | | 12900 | 1.0 | 129 | |
| | 05) main distribution tank | set | 1 | 1378400 | 0.5 | 6892 | |
| | 06) distribution pipe and fittings | m | 44880 | 11327746 | 0.5 | 56639 | |
| | 07) fittings for above 6) | LS | | 3398324 | 1.0 | 33983 | |
| | 08) distribution pump | unit | 0 | 0 | 3.0 | 0 | |
| | 09) distribution tank | set | 8 | 4136320 | 0.5 | 20682 | |
| | 10) stand pipe | place | 25 | 3007500 | 0.5 | 15038 | |
| | 11) electric line | km | 15 | 719220 | 1.0 | 7192 | |
| | 12) access road | km | 3 | 1874100 | 3.0 | 56223 | |
| | sub total | | | | | | 264110 |
| | Rehabilitated facilities | | | | | | |
| | 13) dug hole | place | 7 | 166320 | 1.0 | 1663 | |
| | 14) spring | place | 19 | 672790 | 1.0 | 6728 | |
| | sub total | | | | | | 8391 |
| | total , Ain Defali | | | | | | 272501 |
| Teroual | New constructed facilities | | | | | | |
| | 01) well | set | 2 | 600000 | 2.5 | 15000 | |
| | 02) equipment for well | set | 4 | 1376020 | 3.0 | 41281 | |
| | 03) main feeder pipe | m | 860 | 242912 | 0.5 | 1215 | |
| | 04) fittings & valves for 2) & 3) | LS | | 8600 | 1.0 | 86 | |
| | 05) main distribution tank | set | 1 | 686000 | 0.5 | 3430 | |
| | 06) distribution pipe | m | 12050 | 3499900 | 0.5 | 17500 | |
| | 07) fittings for above 6) | LS | | 1049970 | 1.0 | 10500 | |
| | 08) distribution pump | unit | 0 | 0 | 3.0 | 0 | |
| | 09) distribution tank | set | 3 | 1515200 | 0.5 | 7576 | |
| | 10) stand pipe | place | 9 | 1082700 | 0.5 | 5414 | |
| | 11) electric line | km | 20 | 958960 | 1.0 | 9590 | |
| | 12) access road | km | 0.5 | 312350 | 3.0 | 9371 | |
| | sub total | | | | | | 120960 |
| | Rehabilitated facilities | | | | | | |
| | 13) dug hole | place | 1 | 23760 | 1.0 | 238 | |
| | 14) spring | place | 23 | 814430 | 1.0 | 8144 | |
| | sub total | | | | | | 8382 |
| | total, Teroual | | | | | | 129342 |
| Ain Berda | 01) well | set | 2 | 600000 | 2.5 | 15000 | |
| | 02) equipment for well | set | 2 | 433440 | 3.0 | 13003 | |
| | 03) main feeder pipe | m | 660 | 152240 | 0.5 | 761 | |
| | 04) fittings & valves for 2) & 3) | LS | | 23824 | 1.0 | 238 | |
| | 05) main distribution tank | set | 1 | 362616 | 0.5 | 1813 | |
| | 06) distribution pipe | m | 11100 | 1430960 | 0.5 | 7155 | |
| | 07) fittings for above 6) | LS | | 429288 | 1.0 | 4293 | |
| | 08) distribution pump | unit | 0 | 0 | 3.0 | 0 | |
| | 09) distribution tank | set | 3 | 479492 | 0.5 | 2397 | |
| | 10) stand pipe | place | 4 | 481200 | 0.5 | 2406 | |
| | 11) electric line | km | 2 | 95896 | 1.0 | 959 | |
| | 12) access road | km | 5 | 3123500 | 3.0 | 93705 | |
| | sub total | | | | | | 141731 |
| | rehabilitated facilities | | | | | | |
| | 13) spring | place | 7 | 247870 | 1.0 | 2479 | |
| | sub total | | | | | | 2479 |
| | total Ain Berda | | | | | | 144210 |
| | Total for 3 model areas | | | | | | 546052 |

## Table 3.6.14 Annual Operation Cost for Model Areas
## ( Supply Area by Gravity+Pumping )

| Model area | Cost items | Facilities | Unit | Q'ty | Unit cost ( DH ) | Amount ( DH ) | Total Annual Operation cost ( DH ) |
|---|---|---|---|---|---|---|---|
| Ain Defali | Electric charge | 1) well pump, 11 kw*3 sets | kwh | 114048 | 0.8 | 91238 | |
| | | 2) connection pump, 15kw * 2 | kwh | 103680 | 0.8 | 82944 | |
| | | 3) distribution pump, 18.5 kw * 4 | kwh | 255744 | 0.8 | 204595.2 | |
| | | 4) distribution pump, 1.5 kw * 2 | kwh | 10368 | 0.8 | 8294.4 | |
| | Operator charge | | m/m | 12 | 4000 | 48000 | |
| | Total | | | | | | 435072 |
| Teroual | Electric charge | 1) well pump, 5.5kw*2 sets | kwh | 38016 | 0.8 | 30413 | |
| | | 2) connection pump, 45 kw * 2 | kwh | 311040 | 0.8 | 248832 | |
| | | 3) distribution pump, 30 kw * 4 | kwh | 414720 | 0.8 | 331776 | |
| | | 4) distribution pump, 7.5 kw * 4 | kwh | 103680 | 0.8 | 82944 | |
| | Operator charge | | m/m | 24 | 4000 | 96000 | |
| | Total | | | | | | 789965 |
| Ain Berda | Electric charge | 1) well pump, 5.5kw*2 sets | kwh | 38016 | 0.8 | 30413 | |
| | Operator charge | | m/m | 12 | 4000 | 48000 | |
| | Total | | | | | | 78413 |
| | Total, 3 model areas | | | | | | 1303450 |

Conditions
1) operate by 80 % of rated output
2) annual operation hour is 4320 hour / unit ( 12 hr/day * 30 d/m * 12 m/y )

## Table 3.6.15 Annual Maintenance Cost for Model Areas
## ( Supply Area by Gravity+Pumping )

| Model Area | Facilities | Unit | Q'ty | Investment Cost | Annual Maintenance Cost: Ratio to Investment Cost | Annual Maintenance Cost: Cost | Total Annual Maintenance Cost |
|---|---|---|---|---|---|---|---|
| | | | | ( DH ) | ( % ) | ( DH/Year ) | ( DH/Year ) |
| Ain Defali | New constructed facilities | | | | | | |
| | 01) well | set | 3 | 900000 | 2.5 | 22500 | |
| | 02) equipment for well | set | 5 | 1424160 | 3.0 | 42725 | |
| | 03) main feeder pipe | m | 1290 | 421516 | 0.5 | 2108 | |
| | 04) fittings & valves for 2) & 3) | LS | | 12900 | 1.0 | 129 | |
| | 05) main distribution tank | set | 1 | 1378400 | 0.5 | 6892 | |
| | 06) distribution pipe and fittings | m | 59780 | 15205646 | 0.5 | 76028 | |
| | 07) fittings for above 6) | LS | | 3398324 | 1.0 | 33983 | |
| | 08) distribution pump | unit | 6 | 2146460 | 3.0 | 64394 | |
| | 09) distribution tank | set | 10 | 4734000 | 0.5 | 23670 | |
| | 10) stand pipe | place | 30 | 3609000 | 0.5 | 18045 | |
| | 11) electric line | km | 15 | 719220 | 1.0 | 7192 | |
| | 12) access road | km | 3 | 1874100 | 3.0 | 56223 | |
| | sub total | | | | | | 353889 |
| | Rehabilitated facilities | | | | | | |
| | 13) dug hole | place | 7 | 166320 | 1.0 | 1663 | |
| | 14) spring | place | 19 | 672790 | 1.0 | 6728 | |
| | sub total | | | | | | 8391 |
| | total , Ain Defali | | | | | | 362280 |
| Teroual | New constructed facilities | | | | | | |
| | 01) well | set | 2 | 600000 | 2.5 | 15000 | |
| | 02) equipment for well | set | 4 | 1376020 | 3.0 | 41281 | |
| | 03) main feeder pipe | m | 860 | 242912 | 0.5 | 1215 | |
| | 04) fittings & valves for 2) & 3) | LS | | 8600 | 1.0 | 86 | |
| | 05) main distribution tank | set | 1 | 686000 | 0.5 | 3430 | |
| | 06) distribution pipe | m | 20750 | 5042300 | 0.5 | 25212 | |
| | 07) fittings for above 6) | LS | | 1512690 | 1.0 | 15127 | |
| | 08) distribution pump | unit | 8 | 2365680 | 3.0 | 70970 | |
| | 09) distribution tank | set | 5 | 2344400 | 0.5 | 11722 | |
| | 10) stand pipe | place | 15 | 1804500 | 0.5 | 9023 | |
| | 11) electric line | km | 20 | 958960 | 1.0 | 9590 | |
| | 12) access road | km | 0.5 | 312350 | 3.0 | 9371 | |
| | sub total | | | | | | 212025 |
| | Rehabilitated facilities | | | | | | |
| | 13) dug hole | place | 1 | 23760 | 1.0 | 238 | |
| | 14) spring | place | 23 | 814430 | 1.0 | 8144 | |
| | sub total | | | | | | 8382 |
| | total, Teroual | | | | | | 220406 |
| Ain Berda | 01) well | set | 2 | 600000 | 2.5 | 15000 | |
| | 02) equipment for well | set | 2 | 433440 | 3.0 | 13003 | |
| | 03) main feeder pipe | m | 660 | 152240 | 0.5 | 761 | |
| | 04) fittings & valves for 2) & 3) | LS | | 23824 | 1.0 | 238 | |
| | 05) main distribution tank | set | 1 | 362616 | 0.5 | 1813 | |
| | 06) distribution pipe | m | 11100 | 1430960 | 0.5 | 7155 | |
| | 07) fittings for above 6) | LS | | 429288 | 1.0 | 4293 | |
| | 08) distribution pump | unit | 0 | 0 | 3.0 | 0 | |
| | 09) distribution tank | set | 3 | 479492 | 0.5 | 2397 | |
| | 10) stand pipe | place | 4 | 481200 | 0.5 | 2406 | |
| | 11) electric line | km | 2 | 95896 | 1.0 | 959 | |
| | 12) access road | km | 5 | 3123500 | 3.0 | 93705 | |
| | sub total | | | | | | 141731 |
| | rehabilitated facilities | | | | | | |
| | 13) spring | place | 7 | 247870 | 1.0 | 2479 | |
| | sub total | | | | | | 2479 |
| | total Ain Berda | | | | | | 144210 |
| | Total for 3 model areas | | | | | | 726896 |

Table 3.7.1 Preliminary Design Features of Water Supply Facilities

| Facilities | Features |
|---|---|
| **< Ain Defali >** | |
| (1) Intake Well | 3 - deepwells with 250 mm dia. and 30 m depth at GL 150 m |
| (2) Water Extraction | 3 sets of submersible pumps and electric motors of 11 kw each.power from public line carrier upon extension |
| (3) Connection tank/pump | 1 set RC tank of 50 m3 capacity and 2 sets of pumps of 15 kw each. |
| (4) Transmission & Distribution Tank | Galvanized steel pipe of 125 and 150 mm dia. with 1290 m in total length, RC main distribution tank of 600 $m^3$ in storage capacity at GL 170 m. |
| (5) Distribution | Galvanized steel pipes of 75-200 mm dia. with 45 km in total length, 8 sets of distribution tank and 25units of stand pipes of reinforced concrete. |
| (6) Related Facilities | Extension of electric power cable of 15 km and permanent access road of 3.0 km |
| **< Teroual >** | |
| (1) Intake Well | 2 - deepwells with 250 mm dia and 30 m depth at GL330 m |
| (2) Water Extraction | 2 sets of submersible pumps and electric motors of 5.5 kw each.power from public line carrier upon extension |
| (3) Connection tank/pump | 1 set RC tank of 25 m3, and 2 sets of pump with 45 kw each |
| (4) Transmission & Distribution Tank | Galvanized steel pipe of 75 and 125mm dia. with 860 m in total length, main distribution tank of 280 $m^3$ storage capacity of reinforced concrete at GL 500 m |
| (5) Distribution | Galvanized steel pipes of 89, 100 and125 mm dia. with 12 km in total length, 3 sets of distribution tank and 9 units of stand pipes of reinforced concrete. |
| (6) Related Facilities | Extension of electric power cable of 20 km and permanent access road of 0.5 km |
| **<Ain Berda>** | |
| (1) Intake Well | 2 - deepwells with 250 mm dia. and 30 m depth at GL 810 m |
| (2) Water Extraction | 2 sets of submersible pumps and electric motors of 5.5 kw each. power from public line carrier upon extension |
| (3) Transmission & Distribution Tank | Galvanized steel pipe of 75 and 100 mm dia. with 660 m in total length, main distribution tank of 120 $m^3$ storage capacity of reinforced concrete at GL 830 m |
| (4) Distribution | Galvanized steel pipe of 25, 50, 64, and 75 mm dia. with 11 km in total length, 3 sets. of distribution tank and 4 units of stand pipes of reinforced concrete. |
| (5) Related Facilities | Extension of electric power cable of 2.0 km and permanent access road of 5.0 km |

## Table 3.7.2 Major Construction Work Items and the Quantities (1/2)
## ( Gravity System )

| Construction Work Items | Unit | Quantity |
|---|---|---|
| **A. Construction of facilities** | | |
| (1) Mobilization and preparatory works | - | LS |
| **< Ain Defali >** | | |
| (2) Well site facilities | | |
| 1) well pump, 80 mm dia., 11 kw, head 48 m, 0.69 m3/min. | set | 3 |
| 2) flange and valve | set | 3 |
| 3) control panel | set | 3 |
| 4) connection tank, RC 50 m3 | set | 1 |
| 5) connection pump, 15 kw, 1.38 m3/min., 35 m | set | 2 |
| 6) galvanized steel pipe, 125 and 150 mm dia. | m | 1290 |
| (3) Main distribution tank | | |
| 1) main distribution tank, RC 600 m3 | set | 1 |
| 2) water level sensor | set | 3 |
| (4) Distribution network | | |
| 1) galvanized steel pipe, 75, 89, 100, 125, 150 and 200 mm | km | 45 |
| 2) distribution tank, RC 100, 400 and 600 m3 | set | 8 |
| 6) stand pipe | place | 25 |
| (5) Related facilities | | |
| 1) electric cable extension from existing power line | km | 15.0 |
| 2) permanent access road | km | 3.0 |
| **< Teroual >** | | |
| (6) Well site facilities | | |
| 1) well pump, 60 mm dia., 5.5 kw, head 46 m, 0.33 m3/min. | set | 2 |
| 2) flange and valve | set | 2 |
| 3) control panel | set | 2 |
| 4) connection tank, RC 25 m3 | set | 1 |
| 5) connection pump, 45 kw, 185 m * 65 mm dia., 0.66 m3/min. | set | 2 |
| 6) galvanized steel pipe, 75 and 125 mm dia. | m | 860 |
| (7) Main distribution tank | | |
| 1) main distribution tank, RC 280 m3 | set | 1 |
| 2) water level sensor | set | 2 |
| (8) Distribution network | | |
| 1) galvanized steel pipe, 89, 100 and 125 mm | km | 12 |
| 2) distribution tank, 140 and 280 m3 | set | 3 |
| 3) stand pipes | place | 9 |

Table 3.7.2 Major Construction Work Items and the Quantities (2/2)

| Construction Work Items | Unit | Quantity |
|---|---|---|
| (9) Related facilities | | |
| 1) electric cable extension from existing power line | km | 20.0 |
| 2) permanent access road | km | 0.5 |
| < Ain Berda > | | |
| (10) Well site facilities | | |
| 1) well pump, 50 mm dia., 5.5 kw, head 65 m, 0.18 m3/min. | set | 2 |
| 2) flange and valve | set | 2 |
| 3) control panel | set | 2 |
| 4) galvanized steel pipe, 75 and 100 mm dia. | m | 660 |
| (11) Main distribution tank | | |
| 1) main distribution tank, RC 120 m3 | set | 1 |
| 2) water level sensor | set | 2 |
| (12) Distribution network | | |
| 1) galvanized steel pipe, 25, 50, 64 and 75 mm | km | 11 |
| 2) distribution tank, 10, 30 and 120 m3 | set | 3 |
| 3) stand pipe | place | 4 |
| (13) Related facilities | | |
| 1) electric cable extension from existing power line | km | 2.0 |
| 2) permanent access road | km | 5.0 |
| **B. Rehabilitation of facilities** | | |
| < Ain Defali > | | |
| (1) Dug hole | place | 7 |
| (2) Spring | place | 19 |
| < Teroual > | | |
| (3) Dug hole | place | 1 |
| (4) Spring | place | 23 |
| < Ain Berda > | | |
| (5) Spring | place | 7 |

Table 3.8.5 FIRR (Ain Defali, Gravity and Pumping All project costs)

unt : DH

| | Revenue | Capital Cost | O&M Cost | Total Cost | Net Revenue |
|---|---|---|---|---|---|
| 1995 | | | | | |
| 96 | | 2,839,828 | | 2,839,828 | -2,839,828 |
| 97 | 1,149,577 | 24,207,700 | 277,810 | 24,485,510 | -23,335,933 |
| 98 | 2,507,711 | 22,020,384 | 588,957 | 22,609,341 | -20,101,630 |
| 99 | 3,037,344 | 7,333,057 | 815,434 | 8,148,491 | -5,111,147 |
| 2000 | 3,611,237 | 7,603,309 | 1,066,967 | 8,670,276 | -5,059,039 |
| 01 | 3,755,268 | | 1,066,967 | 1,066,967 | 2,688,301 |
| 02 | 3,899,299 | | 1,066,967 | 1,066,967 | 2,832,332 |
| 03 | 4,043,331 | | 1,066,967 | 1,066,967 | 2,976,364 |
| 04 | 4,187,362 | | 1,066,967 | 1,066,967 | 3,120,395 |
| 05 | 4,331,393 | | 1,066,967 | 1,066,967 | 3,264,426 |
| 06 | 4,486,160 | | 1,066,967 | 1,066,967 | 3,419,193 |
| 07 | 4,640,928 | | 1,066,967 | 1,066,967 | 3,573,961 |
| 08 | 4,795,695 | | 1,066,967 | 1,066,967 | 3,728,728 |
| 09 | 4,950,462 | | 1,066,967 | 1,066,967 | 3,883,495 |
| 10 | 5,105,229 | | 1,066,967 | 1,066,967 | 4,038,262 |
| 11 | 5,259,997 | | 1,066,967 | 1,066,967 | 4,193,030 |
| 12 | 5,414,764 | | 1,066,967 | 1,066,967 | 4,347,797 |
| 13 | 5,569,531 | | 1,066,967 | 1,066,967 | 4,502,564 |
| 14 | 5,274,299 | | 1,066,967 | 1,066,967 | 4,207,332 |
| 15 | 5,879,066 | | 1,066,967 | 1,066,967 | 4,812,099 |
| 16 | 6,033,833 | | 1,066,967 | 1,066,967 | 4,966,866 |

FIRR=0.7%

Table 3.8.6 FIRR (Ain Defali, Gravity and Pumping
Direct Construction Cost Only)

unit : DH

| | Revenue | Capital Cost | O&M Cost | Total Cost | Net Revenue |
|---|---|---|---|---|---|
| 1995 | | | | | |
| 96 | | | | | |
| 97 | 1,149,577 | 16,199,745 | 277,810 | 16,477,555 | -15,327,978 |
| 98 | 2,507,711 | 16,766,522 | 588,957 | 17,355,479 | -14,847,768 |
| 99 | 3,037,344 | 4,871,303 | 815,434 | 5,686,737 | -2,649,393 |
| 2000 | 3,611,237 | 5,036,393 | 1,066,967 | 6,103,360 | -2,492,123 |
| 01 | 3,755,268 | | 1,066,967 | 1,066,967 | 2,688,301 |
| 02 | 3,899,299 | | 1,066,967 | 1,066,967 | 2,832,332 |
| 03 | 4,043,331 | | 1,066,967 | 1,066,967 | 2,976,364 |
| 04 | 4,187,362 | | 1,066,967 | 1,066,967 | 3,120,395 |
| 05 | 4,331,393 | | 1,066,967 | 1,066,967 | 3,264,426 |
| 06 | 4,486,160 | | 1,066,967 | 1,066,967 | 3,419,193 |
| 07 | 4,640,928 | | 1,066,967 | 1,066,967 | 3,573,961 |
| 08 | 4,795,695 | | 1,066,967 | 1,066,967 | 3,728,728 |
| 09 | 4,950,462 | | 1,066,967 | 1,066,967 | 3,883,495 |
| 10 | 5,105,229 | | 1,066,967 | 1,066,967 | 4,038,262 |
| 11 | 5,259,997 | | 1,066,967 | 1,066,967 | 4,193,030 |
| 12 | 5,414,764 | | 1,066,967 | 1,066,967 | 4,347,797 |
| 13 | 5,569,531 | | 1,066,967 | 1,066,967 | 4,502,564 |
| 14 | 5,274,299 | | 1,066,967 | 1,066,967 | 4,207,332 |
| 15 | 5,879,066 | | 1,066,967 | 1,066,967 | 4,812,099 |
| 16 | 6,033,833 | | 1,066,967 | 1,066,967 | 4,966,866 |

FIRR=5.1%

Table 3.8.7 Loan Repayability (Ain Defali, Gravity and Pumping Direct Construction Cost Only)

unit : DH

| | Revenue | O&M Cost | External Soft Loan | | | Domestic (FEC) Loan | | | Net | Acculation of |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 85% of capital cost | Interest | Repayment | 15% of capital cost | Interest | Repayment | Revenue | Net Revenue |
| 1995 | | | | | | | | | | |
| 96 | | | | | | | | | | |
| 97 | 1,149,577 | 277,810 | 13,769,783 | 413,093 | | 2,429,962 | 242,996 | | 215,678 | 215,678 |
| 98 | 2,507,711 | 588,957 | 14,251,544 | 840,640 | | 2,514,978 | 494,494 | | 583,620 | 799,298 |
| 99 | 3,037,344 | 815,434 | 4,140,608 | 964,858 | | 730,695 | 567,564 | | 689,488 | 1,488,786 |
| 2000 | 3,611,237 | 1,066,967 | 4,280,934 | 1,093,286 | | 755,459 | | 801,700 | 649,284 | 2,138,070 |
| 01 | 3,755,268 | 1,066,967 | | 1,093,286 | | | | 801,700 | 793,315 | 2,931,385 |
| 02 | 3,899,299 | 1,066,967 | | | 2,901,217 | | | 801,700 | -870,585 | 2,060,800 |
| 03 | 4,043,331 | 1,066,967 | | | 2,901,217 | | | 801,700 | -726,553 | 1,334,247 |
| 04 | 4,187,362 | 1,066,967 | | | 2,901,217 | | | 801,700 | -582,522 | 751,725 |
| 05 | 4,331,393 | 1,066,967 | | | 2,901,217 | | | 801,700 | -438,491 | 313,234 |
| 06 | 4,486,160 | 1,066,967 | | | 2,901,217 | | | 801,700 | -283,724 | 29,510 |
| 07 | 4,640,928 | 1,066,967 | | | 2,901,217 | | | 801,700 | -128,956 | -99,446 |
| 08 | 4,795,695 | 1,066,967 | | | 2,901,217 | | | 801,700 | 25,811 | -73,635 |
| 09 | 4,950,462 | 1,066,967 | | | 2,901,217 | | | 801,700 | 180,578 | 106,943 |
| 10 | 5,105,229 | 1,066,967 | | | 2,901,217 | | | 801,700 | 335,345 | 442,288 |
| 11 | 5,259,997 | 1,066,967 | | | 2,901,217 | | | 801,700 | 490,113 | 932,401 |
| 12 | 5,414,764 | 1,066,967 | | | 2,901,217 | | | 801,700 | 644,880 | 1,577,281 |
| 13 | 5,569,531 | 1,066,967 | | | 2,901,217 | | | 801,700 | 799,647 | 2,376,928 |
| 14 | 5,274,299 | 1,066,967 | | | 2,901,217 | | | 801,700 | 504,415 | 2,881,343 |
| 15 | 5,879,066 | 1,066,967 | | | 2,901,217 | | | 801,700 | 1,109,182 | 3,990,525 |
| 16 | 6,033,833 | 1,066,967 | | | 2,901,217 | | | 801,700 | 1,263,949 | 5,254,474 |

Table 3.8.10 Economic Cash Flow (Ain Defali, Gravity and Pumping)

unit : DH

| | Benefit | Capital Cost | O&M Cost | Total Cost | Net Revenue |
|---|---|---|---|---|---|
| 1995 | | | | | |
| 96 | | 2,720,858 | | 2,720,858 | -2,720,858 |
| 97 | 1,125,403 | 21,826,095 | 222,525 | 22,048,620 | -20,923,217 |
| 98 | 2,325,009 | 19,105,236 | 445,050 | 19,550,286 | -17,225,277 |
| 99 | 2,399,211 | 6,207,812 | 581,310 | 6,789,122 | -4,389,911 |
| 2000 | 2,972,086 | 6,207,812 | 717,570 | 6,925,382 | -3,953,296 |
| 01 | 3,090,625 | | 717,570 | 717,570 | 2,373,055 |
| 02 | 3,209,164 | | 717,570 | 717,570 | 2,491,594 |
| 03 | 3,327,703 | | 717,570 | 717,570 | 2,610,133 |
| 04 | 3,446,243 | | 717,570 | 717,570 | 2,728,673 |
| 05 | 3,564,782 | | 717,570 | 717,570 | 2,847,212 |
| 06 | 3,692,157 | | 717,570 | 717,570 | 2,974,587 |
| 07 | 3,819,532 | | 717,570 | 717,570 | 3,101,962 |
| 08 | 3,946,907 | | 717,570 | 717,570 | 3,229,337 |
| 09 | 4,074,282 | | 717,570 | 717,570 | 3,356,712 |
| 10 | 4,201,657 | | 717,570 | 717,570 | 3,484,087 |
| 11 | 4,329,032 | | 717,570 | 717,570 | 3,611,462 |
| 12 | 4,456,408 | | 717,570 | 717,570 | 3,738,838 |
| 13 | 4,583,783 | | 717,570 | 717,570 | 3,866,213 |
| 14 | 4,711,158 | | 717,570 | 717,570 | 3,993,588 |
| 15 | 4,838,533 | | 717,570 | 717,570 | 4,120,963 |
| 16 | 4,965,908 | | 717,570 | 717,570 | 4,248,338 |

EIRR=0.6%

## Table 3.9.1 Location and Characteristics of Existing Sampling Sites for Water Quality (1/2)

| Location | No. | Region | Type | Owner's Name | Execution Date | Approximate Coordinates X | Y | Z | Period or Epoch | Lithology | Size (m) | Depth (m) | Approx. Flowrate (l / s) | Static Water Level (m) (as of 15/7/95) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aïn Defalli | 1 | El Arba | Dughole (c) | Al Massire | — | 487150 | 444400 | 110 | Quaternary | Alluvium & conglomerate | 72 | 11-75 | 0-08 | 11.62 |
| | 2 | Beni Senana | Dughole (P) | Ayash Riam | 1993 | 485250 | 444650 | 155 | " | " | 1-8 | 3.91 | 0.7 | 3.5 |
| | 3 | Beni Senana | Spring (c) | Commune | — | 485100 | 444750 | 180 | " | " | | | 0.25 (15-7-95) | |
| | 4 | Beni Senana | Dughole (P) | Rayam Abdeslam | 1991 | 484400 | 444600 | 170 | " | " | 1.4 | 9-35 | 0.05 | 9.0 |
| | 5 | Beni Senana | Dughole (P) | Owni Med. | 1980 | 485100 | 444850 | 165 | " | " | 1-1 | 11-0 | 0.05 | 8.1 |
| | 6 | Beni Senana | Spring (c) | Commune | — | 484600 | 445500 | 185 | " | " | | | 0.166 (15-7-95) | |
| | 7 | Beni Senane | Dughole (P) | Ouezzani Med. | 1993 | 484300 | 445450 | 190 | " | " | 2.0 | 13.0 | 0.3 | 3.6 |
| | 8 | " | " | " | 1986 | 484500 | 445650 | 190 | " | " | 2.0 | 23-9 | 0.5 | 10.25 |
| | 9 | " | " | " | 1991 | 484200 | 445400 | 190 | " | " | 2.0 | 13.0 | 0.3 | 3.75 |
| | 10 | " | " | " | 1993 | 484550 | 445600 | 190 | " | " | 2.0 | 19.25 | 0.3 | 12.76 |
| Teroual | T1 | El Jarrarah | Dughole (P) | Ezzehri Mohamed | 1985 | 512950 | 452760 | | Quaternary (0 - 1 m) Miocene (1 - 3 m) Oligocene (3 - 6.2 m) | Alluvium deposits Marl & conglomerates Silty marl & siltstone | 1.35 | 6.2 | 0.08 | 5.9 |
| | T2 | " | " | Hadrouz El Arbi | 1993 | 513000 | 452750 | | Ditto | Ditto | 1.55 | 8.3 | 0.01 | 7.95 |

## Table 3.9.1 Location and Characteristics of Existing Sampling Sites for Water Quality (2/2)

| Location | No. | Region | Type | Owner's Name | Execution Date | Approximate Coordinates | | | Period or Epoch | Lithology | Size (m) | Depth (m) | Approx. Flowrate (l / s) | Static Water Level (m) (as of 15/7/95) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | X | Y | Z | | | | | | |
| Teroual | T3 | " | | Chekri Ahmed | 1995 | 512950 | 453050 | | Miocene (0 - 2 m) Oligocene (2 - 13.8 m) | Marl & conglomerates Silty marl & siltstone | 1.55 | 13.8 | 0.005 | 13.5 |
| | T4 | " | Spring (c) | Commune | — | 511500 | 452600 | 405 | Quaternary Miocene | Alluvium & Marl | — | — | 0.73 (15/7/95) | — |
| J. Berda | AB1 | A.Tazrhadra | Spring (c) | Commune | — | 547500 | 447800 | 550 | Cretaceous superior | Marl and Marly limestone | — | — | 3.58 (12/7/95) | |
| | AB2 | Aïn Martab | Spring (c) | Commmune | — | 548650 | 446600 | 590 | " | " | — | — | 0.405 (15/7/95) | |
| | AB3 | Aïn Berda | Spring (c) | Commune | — | 550650 | 446850 | 740 | " | " | — | — | 0.092 (15/7/95) | |
| | AB4 | Aïn Berda | Dughole (c) | A.H. | 1983 | 550850 | 446950 | 740 | " | " | 1.67 | 15.5 | 0.005 | 15.0 |
| | AB5 | Aïn Bou Khalfoune | Spring (c) | Commune | — | 549850 | 447500 | 770 | " | " | — | — | 0.113 | — |
| | AB6 | El Aïn | Dughole (P) | Motasem Med. | 1940 | 550100 | 446850 | 765 | " | " | 1.0 x 1.0 (square) | 10-33 | 0.1 | 10-28 |
| | AB7 | Ras El Koubour | " | Fenassi Med. | 1984 | 550000 | 446700 | 775 | " | " | 2 x 2 (square) | 10.94 | 0.005 | 11-15 |

## Table 3.9.2 Water Quality of Wells, Springs and Dugholes in Model Areas (1/2)

| Sampling Site | Type | 1 Temp. °C | 2 pH | 3 EC ms/m | 4 Na mg/l | 5 K mg/l | 6 Ca mg/l | 7 Mg mg/l | 8 Fe mg/l | 9 Mn mg/l | 10 NH4 mg/l | 11 HCO3 mg/l | 12 CO3 mg/l | 13 Cl mg/l | 14 SO4 mg/l | 15 NO3 mg/l | 16 Total coliform MPN /100 ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recommended value | | — | 6.5-8.5 | 130 | 200 | — | 75 | 100 | 0.3 | 0.1 | 0.05 | — | 500 | 300 | 200 | 45 | 0 |
| Ain Defali | | | | | | | | | | | | | | | | | |
| 1 | Dughole (c) | 26.1 | 6.16 | 35.1 | 22.0 | 1.92 | 32.1 | 13.52 | 0.43 | 0.21 | 0.333 | 42.7 | 13.6 | 60.4 | 6.3 | 84.0 | 270 |
| 2 | Dughole (p) | 28.0 | 6.63 | 28.3 | 13.0 | 0.85 | 27.3 | 14.50 | 0.06 | 0.02 | 0.245 | 97.6 | 12.8 | 35.5 | 3.4 | 13.4 | 90 |
| 3 | Spring (c) | 29.2 | 7.11 | 22.3 | 10.0 | 1.21 | 30.5 | 6.74 | 0.13 | 0.02 | 0.034 | 97.6 | 10.4 | 17.8 | 0.8 | 12.2 | 37 |
| 4 | Dughole (c) | 24.2 | 5.87 | 99.5 | 42.0 | 4.86 | 77.0 | 39.60 | 0.02 | 0.42 | 0.058 | 36.6 | 35.6 | 149.1 | 0.8 | 258.0 | 80 |
| 5 | Dughole (p) | 24.2 | 6.47 | 21.6 | 13.0 | 2.26 | 24.0 | 7.72 | 0.52 | 0.63 | 0.010 | 48.8 | 9.2 | 35.5 | 1.5 | 32.8 | 29 |
| 6 | Spring (c) | 25.5 | 6.88 | 58.9 | 25.0 | 1.59 | 70.5 | 11.53 | 0.02 | 0.01 | 0.005 | 122.0 | 22.4 | 78.1 | 1.9 | 94.5 | 90 |
| 7 | Dughole (p) | 24.0 | 7.93 | 41.2 | 25.0 | 15.01 | 40.1 | 9.63 | 0.07 | 0.01 | 0.005 | 170.8 | 14.0 | 24.9 | 25.9 | 3.0 | 0 |
| 8 | Dughole (p) | 24.1 | 7.71 | 205.0 | 276.0 | 20.53 | 81.8 | 41.53 | 0.02 | 0.03 | 0.024 | 366.0 | 37.6 | 482.8 | 40.5 | 42.1 | 510 |
| 9 | Dughole (p) | 24.1 | 7.03 | 24.7 | 12.0 | 1.24 | 30.5 | 4.80 | 0.02 | 0.02 | 0.003 | 91.5 | 9.6 | 28.4 | 2.8 | 19.8 | 380 |
| 10 | Dughole (p) | 24.1 | 6.91 | 26.2 | 12.0 | 0.34 | 36.9 | 6.73 | 0.02 | 0.03 | 0.002 | 122.0 | 12.0 | 23.1 | 2.7 | 18.5 | 0 |
| 11 | Dughole (c) | 24.6 | 8.30 | 41.1 | 16.0 | 8.03 | 57.6 | 3.87 | 0.20 | 0.03 | 0.112 | 195.2 | 16.0 | 21.3 | 4.7 | 0.7 | 50 |
| 12 | Dughole (p) | 22.1 | 9.81 | 29.9 | 16.0 | 6.59 | 36.8 | 18.40 | 0.07 | 0.01 | 0.231 | 103.7 | 16.8 | 39.1 | 1.5 | 19.7 | 90 |
| 13 | Dughole (p) | 23.6 | 7.54 | 47.2 | 27.0 | 10.93 | 40.0 | 12.10 | 0.13 | 0.01 | 0.203 | 176.9 | 15.0 | 32.0 | 25.6 | 25.9 | 29 |
| 14 | Dughole (p) | 22.9 | 7.13 | 30.8 | 15.0 | 1.67 | 32.0 | 4.84 | 0.07 | 0.03 | 0.044 | 73.2 | 13.6 | 32.0 | 2.6 | 23.9 | 0 |
| 15 | (Existing well) | 24.0 | 7.13 | 48.2 | 32.0 | 0.91 | 46.4 | 4.84 | 0.18 | 0.03 | 0.117 | 91.5 | 0 | 67.5 | 1.0 | 57.4 | 5 |

Note : (c) : Owned by the com (p) Private (AH) : Developed by the Administration of Hydraulics

## Table 3.9.2 Water Quality of Wells, Springs and Dugholes in Model Areas (2/2)

| Sampling Site | Type | 1 Temp. °C | 2 pH | 3 EC ms/m | 4 Na mg/l | 5 K mg/l | 6 Ca mg/l | 7 Mg mg/l | 8 Fe mg/l | 9 Mn mg/l | 10 NH4 mg/l | 11 HCO3 mg/l | 12 CO3 mg/l | 13 Cl mg/l | 14 SO4 mg/l | 15 NO3 mg/l | 16 Total coliform MPN /100 ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recommended value | | | 6.5-8.5 | 130 | 200 | | 75 | 100 | 0.3 | 0.1 | 0.05 | — | 500 | 300 | 200 | 45 | 0 |
| Teroual | | | | | | | | | | | | | | | | | |
| T1 | Dughole (p) | 23.4 | 7.31 | 59.6 | 22.0 | 5.28 | 70.4 | 25.17 | 0.02 | 0.11 | 0.593 | 326.4 | 28.0 | 17.8 | 14.8 | 0.1 | 50 |
| T2 | Dughole (p) | 21.0 | 7.31 | 57.4 | 13.0 | 2.11 | 86.4 | 17.42 | 0.39 | 0.09 | 0.264 | 335.5 | 28.8 | 42.5 | 7.8 | 3.0 | 620 |
| T3 | Dughole (p) | 23.6 | 8.02 | 209.0 | 423.0 | 8.70 | 35.2 | 13.55 | 1.28 | 0.06 | 0.952 | 219.6 | 14.4 | 241.4 | 436.8 | 27.9 | 600 |
| T4 | Spring (c) | 23.6 | 7.22 | 55.0 | 16.0 | 1.16 | 96.0 | 11.62 | 0.03 | 0.04 | 0.050 | 335.5 | 28.8 | 31.9 | 9.1 | 9.6 | 5 |
| Ain Berda | | | | | | | | | | | | | | | | | |
| AB1 | Spring (c) | 19.9 | 7.62 | 51.6 | 11.0 | 1.75 | 70.4 | 21.30 | 0.11 | 0.02 | 0.120 | 146.4 | 24.8 | 21.3 | 85.9 | 13.3 | 330 |
| AB2 | Spring (c) | 22.3 | 7.66 | 39.1 | 12.0 | 1.29 | 51.2 | 15.50 | 0.16 | 0.02 | 0.110 | 183.0 | 19.2 | 17.8 | 11.6 | 22.0 | 740 |
| AB3 | Spring (c) | 23.5 | 7.92 | 80.0 | 31.0 | 40.52 | 70.4 | 25.17 | 0.19 | 0.02 | 0.040 | 146.4 | 28.0 | 63.9 | 32.6 | 191.4 | 150 |
| AB4 | Dughole (AH) | 20.6 | 7.52 | 113.1 | 28.0 | 25.96 | 116.8 | 58.08 | 0.25 | 0.03 | 0.030 | 341.6 | 53.2 | 67.5 | 158.7 | 38.1 | 790 |
| AB5 | Spring (c) | 21.8 | 7.89 | 33.0 | 5.0 | 0.19 | 51.2 | 15.50 | 0.17 | 0.01 | 0.090 | 158.6 | 19.2 | 10.7 | 33.8 | 25.0 | 51 |
| AB6 | Dughole (p) | 19.9 | 7.73 | 74.0 | 29.0 | 32.34 | 60.8 | 25.17 | 0.26 | 0.05 | 0.010 | 137.3 | 25.6 | 53.3 | 27.6 | 165.7 | 600 |
| AB7 | Dughole (p) | 21.3 | 7.12 | 156.0 | 54.0 | 5.57 | 176.0 | 96.80 | 0.19 | 0.07 | 0.100 | 478.9 | 131.8 | 140.2 | 215.3 | 138.1 | 300 |
| AB8 | Dughole (p) | 21.5 | 11.80 | 475.0 | 49.0 | 40.53 | 522.4 | 2.90 | 0.10 | 0.01 | 0.444 | 732.0 | 80.0 | 106.5 | 285.8 | 1.1 | 40 |
| AB9 | Dughole (p) | 22.8 | 7.30 | 154.6 | 18.0 | 1.03 | 208.0 | 67.76 | 0.33 | 0.03 | 0.155 | 439.2 | 70.0 | 78.1 | 289.0 | 1.9 | 60 |
| AB10 | Dughole (p) | 23.5 | 7.17 | 171.5 | 47.0 | 5.20 | 224.0 | 33.90 | 0.10 | 0.05 | 0.187 | 366.0 | 67.0 | 135.0 | 89.4 | 259.8 | 280 |
| AB11 | Dughole (p) | 23.7 | 7.14 | 137.4 | 39.0 | 7.38 | 160.0 | 67.76 | 3.05 | 0.17 | 0.033 | 610.0 | 0 | 99.4 | 63.1 | 0.3 | 610 |

Note : (c) : Owned by the com (p) Private (AH) : Developed by the Administration of Hydraulics

## Table 3.9.3 Water Quality of Exploratory Wells

| Sampling Site | 1 Temp. °C | 2 pH | 3 EC ms/m | 4 Na mg/l | 5 K mg/l | 6 Ca mg/l | 7 Mg mg/l | 8 Fe mg/l | 9 Mn mg/l | 10 NH4 mg/l | 11 HCO3 mg/l | 12 CO3 mg/l | 13 Cl mg/l | 14 SO4 mg/l | 15 NO3 mg/l | 16 Total coliform MPN /100 ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Recommended value | — | 6.5-8.5 | 130.00 | 200.0 | — | 75 | 100 | 0.3 | 0.1 | 0.05 | — | 500 | 300 | 200 | 45 | 0 |
| JBD2 | 18.2 | 8.00 | 30.4 | 118.6 | 0.30 | 48.1 | 37.92 | 0.20 | 0.05 | 0.050 | 384.3 | 0.0 | 38.1 | 21.2 | 22.1 | 15 |
| JBD3 | 16.1 | 8.30 | 87.0 | 57.0 | 45.00 | 56.0 | 12.58 | 0.77 | 0.02 | 0.216 | 176.9 | 3.0 | 58.6 | 29.2 | 151.0 | 40 |
| ADF1 | 22.6 | 7.18 | 30.0 | 14.0 | 0.70 | 32.0 | 4.84 | 0.05 | 0.03 | 0.008 | 85.4 | 3.0 | 26.6 | 0.8 | 14.6 | 20 |
| ADF2 | 21.6 | 7.39 | 47.7 | 30.0 | 0.45 | 48.0 | 9.20 | 0.20 | 0.03 | 0.006 | 170.8 | 0.0 | 42.6 | 0.8 | 30.0 | 12 |
| ADF3 | 22.1 | 6.86 | 42.9 | 20.36 | 0.30 | 14.0 | 4.86 | 0.10 | 0.04 | 0.0025 | 54.9 | 0.0 | 21.3 | 1.5 | 8.8 | 20 |
| TRA2 | 21.2 | 7.07 | 72.6 | 57.72 | 1.36 | 121.8 | 13.61 | 0.20 | 0.03 | 0.048 | 384.3 | 0.0 | 51.5 | 8.1 | 20.5 | 10 |
| TRA3 | 21.8 | 7.00 | 68.6 | 33.93 | 0.76 | 118.6 | 9.72 | 0.15 | 0.08 | 0.0326 | 366.0 | 0.0 | 42.6 | 3.0 | 21.4 | 26 |

Table 4.1.1 Water Production at Ain Gdah W.T.P

| Year | Month | Water Production | | | |
|---|---|---|---|---|---|
| | | Total | Average | Peak | |
| | | ( m3 ) | ( m3/d ) | ( m3/d ) | ( l/s ) |
| 1993 | January | 16,866 | 544 | 1343 | 15.5 |
| | February | 15,474 | 553 | 1620 | 18.8 |
| | March | 15,106 | 487 | 1881 | 21.8 |
| | April | 20,904 | 697 | 1857 | 21.5 |
| | May | 25,364 | 818 | 2903 | 33.6 |
| | June | 30,127 | 1,004 | 2170 | 25.1 |
| | July | 40,050 | 1,292 | 2661 | 30.8 |
| | August | 51,335 | 1,656 | 3300 | 38.2 |
| | September | 32,133 | 1,071 | 1898 | 22.0 |
| | October | 19,232 | 620 | 1660 | 19.2 |
| | November | 13,687 | 456 | 1363 | 15.8 |
| | December | 10,010 | 323 | 967 | 11.2 |
| 1994 | January | 13,700 | 442 | 900 | 10.4 |
| | February | 11,200 | 400 | 700 | 8.1 |
| | March | 17,100 | 552 | 1000 | 11.6 |
| | April | 21,708 | 724 | 1152 | 13.3 |
| | May | 28,296 | 913 | 1620 | 18.8 |
| | June | 37,600 | 1,253 | 1435 | 16.6 |
| | July | 46,600 | 1,503 | 1700 | 19.7 |
| | August | 43,470 | 1,402 | 1925 | 22.3 |
| | September | 38,016 | 1,267 | 1440 | 16.7 |
| | October | 31,335 | 1,011 | 2167 | 25.1 |
| | November | 21,446 | 715 | 1139 | 13.2 |
| | December | - | - | - | - |
| Max. | | 51,335 | 1,656 | 3,300 | 38.2 |
| Min. | | 10,010 | 323 | 700 | 8.1 |
| Average | | 28,171 | 921 | 1,779 | 20.6 |

Source: ONEP Fes

Table 4.1.2 Water Production at M'kansa W.T.P

| Year | Month | Water Production | | | |
|---|---|---|---|---|---|
| | | Total | Average | Peak | |
| | | ( m3 ) | ( m3/d ) | ( m3/d ) | ( l/s ) |
| 1993 | January | 9,753 | 315 | 545 | 6.3 |
| | February | 9,102 | 325 | 709 | 8.2 |
| | March | 7,807 | 252 | 709 | 8.2 |
| | April | 9,701 | 323 | 785 | 9.1 |
| | May | 8,771 | 283 | 853 | 9.9 |
| | June | 10,671 | 356 | 667 | 7.7 |
| | July | 14,444 | 466 | 818 | 9.5 |
| | August | 13,865 | 447 | 681 | 7.9 |
| | September | 10,546 | 352 | 699 | 8.1 |
| | October | 8,650 | 279 | 553 | 6.4 |
| | November | 7,977 | 266 | 893 | 10.3 |
| | December | 6,716 | 217 | 637 | 7.4 |
| 1994 | January | 7,981 | 257 | 471 | 5.5 |
| | February | 5,393 | 193 | 533 | 6.2 |
| | March | 6,422 | 207 | 512 | 5.9 |
| | April | 8,501 | 283 | 488 | 5.6 |
| | May | 12,690 | 409 | 692 | 8.0 |
| | June | 13,099 | 437 | 707 | 8.2 |
| | July | 16,894 | 545 | 699 | 8.1 |
| | August | 17,581 | 567 | 829 | 9.6 |
| | September | 15,091 | 503 | 773 | 8.9 |
| | October | 17,628 | 569 | 990 | 11.5 |
| | November | 10,289 | 343 | 507 | 5.9 |
| | December | - | - | - | - |
| Max. | | 17,628 | 569 | 990 | 11.5 |
| Min. | | 5,393 | 193 | 471 | 5.5 |
| Average | | 11,288 | 369 | 704 | 8.2 |

## Table 4.1.4 Water Production and Consumption in Taounate Province, 1994

| | Water Supply Center | Popula-tion | House Connect. | Water Produc. (m3) | Water Distribu. (m3) | Water Consum. (m3) | Relative UW Consum. (l/c/d) | Revenue Ratio (%) | Unaccounted for Water (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Taounate | 24,379 | 3,297 | 677,686 | 654,543 | 531,874 | 59.8 | 78.5 | 21.5 |
| 2 | Karia Ba Mohamed | 13,270 | 1,234 | 489,936 | 450,606 | 307,308 | 63.4 | 62.7 | 37.3 |
| 3 | Mly Bouchta | 3,140 | 32 | 9,934 | 9,132 | 6,251 | 5.5 | 62.9 | 37.1 |
| 4 | M'kansa | 21,331 | 251 | 143,478 | 137,652 | 92,997 | 11.9 | 64.8 | 35.2 |
| 5 | Ain Gdah | 29,478 | 368 | 335,065 | 323,788 | 151,755 | 14.1 | 45.3 | 54.7 |
| 6 | Tissa | 7,059 | 680 | 164,252 | 156,910 | 112,630 | 43.7 | 68.6 | 31.4 |
| 7 | Rhafsai | 4,255 | 737 | 87,140 | 82,784 | 54,363 | 35.0 | 62.4 | 37.6 |
| 8 | Ouartzagh | 2,638 | 234 | 27,934 | 26,538 | 13,064 | 13.6 | 46.8 | 53.2 |
| 9 | Ain Aicha | 4,000 | 193 | 8,500 | 8,076 | 5,060 | 3.5 | 59.5 | 40.5 |
| | Total | 109,550 | 7,026 | 1,943,925 | 1,850,029 | 1,275,302 | (Ave.)31.9 | (Ave.)65.6 | (Ave.)34.4 |

Source: ONEP Taounate
UW: Unit Water

## Table 4.1.5 Water Production and Consumption in Taounate Province ( January, February and March, 1995 )

| | Water Supply Center | Popula-tion | House Connect. | Water Produc. (m3) | Water Distribu. (m3) | Water Consum. (m3) | Relative UW Consum. (l/c/d) | Revenue Ratio (%) | Unaccounted for Water (%) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Taounate | 24,379 | 3,470 | 205,383 | 201,276 | 125,975 | 57.4 | 61.3 | 38.7 |
| 2 | Karia Ba Mohamed | 13,270 | 1,234 | 112,262 | 104,382 | 76,633 | 64.2 | 68.3 | 31.7 |
| 3 | Mly Bouchta | 3,140 | 32 | 1,820 | 1,583 | 1,460 | 5.2 | 80.2 | 19.8 |
| 4 | M'kansa | 21,331 | 251 | 27,907 | 25,100 | 18,598 | 9.7 | 66.6 | 33.4 |
| 5 | Ain Gdah | 29,478 | 368 | 74,192 | 70,721 | 29,204 | 11.0 | 39.4 | 60.6 |
| 6 | Tissa | 7,059 | 749 | 42,448 | 38,975 | 29,504 | 46.4 | 69.5 | 30.5 |
| 7 | Rhafsai | 4,255 | 737 | 10,884 | 10,367 | 7,680 | 20.1 | 70.6 | 29.4 |
| 8 | Ouartzagh | 2,638 | 234 | 11,197 | 10,636 | 5,143 | 21.7 | 45.9 | 54.1 |
| 9 | Ain Aicha | 4,000 | 193 | 4,116 | 3,650 | 2,419 | 6.7 | 58.8 | 41.2 |
| | Total | 109,550 | 7,268 | 490,209 | 466,690 | 296,616 | (Ave.) 30.1 | (Ave.) 60.5 | (Ave.) 39.5 |

Source: ONEP Taounate
UW: Unit Water

## Table 4.1.6 Water Requirement and Demands, Rural Center of Taounate

| | | Statistics | | | | | | | | Projection | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1991 | 1995 | 2000 | 2010 | 2020 |
| Population | a | 10,800 | 11,400 | 12,100 | 12,700 | 13,400 | 14,100 | 14,700 | 15,300 | 16,900 | 18,900 | 21,000 | 26,000 | 32,300 |
| Rate of Increase (%) | b | | | | | 5.1 | | | | 3.6 | | 2.17 | 2.17 | 2.17 |
| Rate of Service (%) | c | 50 | 55 | 58 | 59 | 64 | 68 | 72 | 83 | 85 | 90 | 95 | 97 | 98 |
| Served Population | d | 5,400 | 6,270 | 7,018 | 7,493 | 8,576 | 9,588 | 10,584 | 12,699 | 14,365 | 17,010 | 19,950 | 25,220 | 31,654 |
| Non Served Population | e | 5,400 | 5,130 | 5,082 | 5,207 | 4,824 | 4,512 | 4,116 | 2,601 | 2,535 | 1,890 | 1,050 | 780 | 646 |
| **Water Consumption (m3/d)** | | | | | | | | | | | | | | |
| 1) By Served Population | f | 520 | 548 | 603 | 877 | 553 | 617 | 658 | 822 | 1077 | 1361 | 1696 | 2272 | 2845 |
| 2) By non Served Population | g | 0 | 36 | 52 | 55 | 0 | 0 | 0 | 0 | 25 | 19 | 11 | 8 | 6 |
| 3) By Administration | h | 140 | 205 | 192 | 123 | 69 | 181 | 175 | 214 | 254 | 284 | 315 | 390 | 484 |
| 4) Industrial | i | 0 | 82 | 101 | 79 | 74 | 88 | 101 | 126 | 135 | 151 | 168 | 208 | 258 |
| 5) Others | j | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | k | 660 | 871 | 948 | 1134 | 696 | 886 | 934 | 1162 | 1491 | 1815 | 2190 | 2878 | 3593 |
| **Unit Water Consumption (l/c/d)** | | | | | | | | | | | | | | |
| 1) By Served Population (f/d*1000) | l | 96 | 87 | 86 | 117 | 65 | 64 | 62 | 65 | 75 | 80 | 85 | 90 | 90 |
| 2) By non Served Population (g/e*1000) | m | 0 | 7 | 10 | 11 | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 10 |
| 3) By Administration (h/a*1000) | n | 13 | 18 | 16 | 10 | 5 | 13 | 12 | 14 | 15 | 15 | 15 | 15 | 15 |
| 4) Industrial (i/a*1000) | o | 0 | 7 | 8 | 6 | 6 | 6 | 7 | 8 | 8 | 8 | 8 | 8 | 8 |
| Net Water Consumption (k/a*1000) | p | 61 | 76 | 78 | 89 | 52 | 63 | 64 | 76 | 88 | 96 | 104 | 111 | 111 |
| Gross Water Consumption (w*86400/a) | q | 64 | 99 | 110 | 122 | 107 | 102 | 99 | 136 | 145 | 141 | 137 | 146 | 147 |
| **Efficiency(%)** | | | | | | | | | | | | | | |
| 1) Network | r | 95 | 81 | 76 | 78 | 52 | 68 | 69 | 61 | 64 | 71 | 80 | 80 | 80 |
| 2) Transmission | s | 100 | 95 | 94 | 94 | 94 | 91 | 93 | 92 | 95 | 95 | 95 | 95 | 95 |
| Global Efficiency (k/(w/1000*86400)) | t | 95 | 77 | 71 | 73 | 48 | 62 | 64 | 56 | 61 | 68 | 76 | 76 | 75 |
| **Water Demand at Distribution (l/s)** | | | | | | | | | | | | | | |
| 1) Average Demand (w*r) | u | 8 | 12 | 14 | 17 | 16 | 15 | 16 | 22 | 27 | 29 | 32 | 42 | 52 |
| 2) Peak Demand (w*s) | v | 10 | 16 | 19 | 22 | 20 | 20 | 20 | 29 | 35 | 38 | 41 | 54 | 68 |
| **Water Production (l/s)** | | | | | | | | | | | | | | |
| 1) Average production | w | 8 | 13 | 15 | 18 | 17 | 17 | 17 | 24 | 28 | 31 | 33 | 44 | 55 |
| 2) Peak Production | x | 10 | 17 | 20 | 23 | 22 | 22 | 22 | 31 | 37 | 40 | 43 | 57 | 71 |

Source: ONEP Taounate

Table 4.2.1 Hydrogeological Details of Fair to Low Groundwater Sources

| Location of Structure | Appox. Coordinates (1000) | | Eleva-tion (m) | Outcropping Formations | Water Potential | |
|---|---|---|---|---|---|---|
| | X | Y | Z | | Flow | Depth |
| **Mountainous structures** | | | | | | |
| - Between Oued Azghar and Taïneste | 610 | 440 | 1300 | Jurassic/Cretaceous | 2-5 l/s | 125 m |
| - Region of Sebbaba W of Taïneste | 610 | 440 | 1400 | Ditto | 2-5 l/s | 125 m |
| - Between Oued Ouergha and Afress | 605 | 455 | 800 | Jurassic/Upper Cretaceous | 1-3 l/s | 150 m |
| - S. of Oued Ouergha & E. of Bouadel | 585 | 430 | 1000 | Ditto | 1-5 l/s | 150 m |
| **Hilly structures** | | | | | | |
| - Jbel Seddine east of Oued Guejawa | 552 | 407 | 550 | Miocene/Tortonian | 1-3 l/s | 125 m |
| - NW of My. Bouchta & E. of J. Khil | 525 | 433 | 350 | Up/Tortonian | 1-3 l/s | 125 m |
| - Between O. Ouergha & Dr. Zeroual | 508 | 428 | 350 | Cretaceous/Oligocene | 1-2.5 l/s | 150 m |
| - Between Dr. Zeroual & Dr. Skhaskha | 505 | 420 | 350 | Ditto | 1-2.5 l/s | 150 m |
| - Jbel Ouannane area NW of Aïn Dorij | 505 | 445 | 200 | Oligocene | 1-3 l/s | 150 m |
| - Jbel Hafa Radi north of Teroual | 510 | 455 | 610 | Oligocene | 1-3 l/s | 150 m |
| **Flat plain Structures** | | | | | | |
| - O. Ouergha (A. Aïcha to A. Mediouna) | 577-565 | 430-435 | 250 | Quaternary/Alluvium | 1-3 l/s | 75 m |
| - O. Ouergha East of Ourtzagh | 540-550 | 437-440 | 150 | Ditto | 1-3 l/s | 75 m |
| - O. Ouergha South of Kissane | 436-442 | 523-536 | 140 | Ditto | 1-3 l/s | 75 m |
| - O. Ouergha South of Jorf El Melha | 495 | 431 | 70 | Ditto | 1-2 l/s | 60 m |
| - O. Ouergha NW of Khnichet | 480 | 428 | 40 | Ditto | 1-2 l/s | 50 m |

## Table 4.2.2 Hydrogeological Details of Low Potential Groundwater Sources

| Location of Structure | Approx. Coordinates (1000) | | Elevation (m) | Outcropping Formations | Water Potential | |
|---|---|---|---|---|---|---|
| | X | Y | Z | | Flow | Depth |
| **Hilly Structures** | | | | | | |
| - Between O. Inaouen & Outa Boubane | 593 | 402 | 450 | Cretaceous/Oligocene | 1-2.5 l/s | 125 m |
| - Between RS 301 and RS 318 | 570-580 | 415-427 | 500 | Oligocene | 1-2 l/s | 150 m |
| - Jbel Miyaiha East of Bouarouss | 560 | 420 | 400 | Eocene/Oligocene | 1-2 l/s | 125 m |
| - North of Bouarouss include. O. Jemaa | 555 | 420 | 400 | Cretaceous/Oligocene | 1-2 l/s | 125 m |
| - North West of Bouarouss | 550 | 425 | 500 | Oligocene | 1-2 l/s | 125 m |
| - Bled S. Bou Jemaa West of Bouchabel | 534 | 425 | 300 | Cretaceous/Oligocene | 1-2 l/s | 125 m |
| - W of J. Bibane & J. Haikiya, E of Kissane | 530 | 442 | 500 | L/M Miocene | 1-2 l/s | 125 m |
| - Between Tafrant, Haddarine & Ghafsaï | 530-542 | 450 | 550 | L/M Miocene | 1-2 l/s | 125 m |
| **Flat Plain Structures** | | | | | | |
| - O. Marticha (El Ghouzate - Had Msila) | 615 | 420-430 | 600 | Quaternary/Alluvium | 1-2 l/s | 75 m |
| - O. Ouergha South of Bouhouda | 580-590 | 440 | 370 | Quaternary | 1-1.5 l/s | 50 m |
| - O. Bouaroussa North of Bouhouda | 578 | 450 | 400 | Quaternary/Alluvium | 1-2 l/s | 50 m |
| - O. Sra West of Bouhouda | 575 | 450 | 400 | Ditto | Ditto | Ditto |
| - O. Lebene NE and SW of Ras El Oued | 579-584 | 415-425 | 250 | Ditto | Ditto | Ditto |
| - O. Inaouen (Oued Amlil - Chebbabat) | 590-600 | 392-399 | 250 | Ditto | Ditto | Ditto |
| - O. Sra East of Taounate | 572 | 435 | 400 | Ditto | Ditto | Ditto |
| - O. Sahela West of Taounate | 565 | 435 | 250 | Ditto | Ditto | Ditto |
| - O. Ouergha (A. Aicha - East of Ghafsai) | 550-570 | 432 | 200 | Ditto | Ditto | Ditto |
| - O. Jemaa (Bouarouss - O. Jemaa) | 570 | 407-420 | 200 | Ditto | Ditto | Ditto |
| - O. Sebou South of Oulja | 545 | 405 | 150 | Ditto | 1-1.5 l/s | Ditto |
| - O. Izar North of Oulja | 543 | 410-417 | 200 | Ditto | Ditto | Ditto |
| - O. Bouchabel South east of Bouchabel | 525-538 | 415-420 | 130 | Ditto | Ditto | Ditto |
| - O. Habbalat (Karia - My. Bouchta) | 525 | 420-430 | 130 | Ditto | Ditto | Ditto |
| - O. Aoudour (Tafrant - Tabouda) | 526 | 448-458 | 120 | Ditto | Ditto | Ditto |
| - O. Aoudiyar (RP 26 and Haddarine) | 520 | 444-455 | 200 | Ditto | Ditto | Ditto |
| - O. Rdat (Ain Defali - O. Sebou | 455-480 | 440 | 60 | Ditto | Ditto | Ditto |
| - O. Et Tine ( Had Kourt - O. Sebou) | 460 | 430-450 | 60 | Ditto | Ditto | Ditto |

## Table 4.2.4 Preliminary Evaluation of Groundwater Deveopment Yield

**Average Year**

| Structure | Area (sq. km) | Annual Rainfall (mm/yr) | Recharge Rate (%) | Recharge (mm/yr) | Groundwater Resource (Million m3/yr) | (m3/day) |
|---|---|---|---|---|---|---|
| Tainaste | 3 | 769 | 12 | 92 | 0.277 | 758 |
| J. Khamise | 8 | 724 | 12 | 87 | 0.695 | 1903 |
| J. Keil | 40 | 796 | 12 | 96 | 3.821 | 10468 |
| J. Berda | 6.3 | 953 | 12 | 114 | 0.720 | 1974 |
| Thar Souk | 12 | 724 | 12 | 87 | 1.042 | 2855 |
| Teroual | 6.1 | 775 | 9 | 70 | 0.425 | 1166 |
| Ourtzagh | 15 | 729 | 9 | 66 | 0.984 | 2696 |
| Ain Saddine | 10 | 649 | 9 | 58 | 0.584 | 1600 |
| Taounate | 4 | 823 | 9 | 74 | 0.296 | 812 |
| Tissa | 5 | 524 | 9 | 47 | 0.236 | 646 |
| Jorf El Melha | 10 | 499 | 9 | 45 | 0.449 | 1231 |
| Ain Defali | 12.0 | 587 | 9 | 53 | 0.634 | 1737 |
| Had Kourt | 6 | 519 | 9 | 47 | 0.280 | 768 |

**10-Year Drought**

| Structure | Area (sq. km) | Annual Rainfall (mm/yr) | Recharge Rate (%) | Recharge (mm/yr) | Groundwater Resource (Million m3/yr) | (m3/day) |
|---|---|---|---|---|---|---|
| Tainaste | 3 | 473 | 8 | 38 | 0.114 | 311 |
| J. Khamise | 8 | 445 | 8 | 36 | 0.285 | 781 |
| J. Keil | 40 | 490 | 8 | 39 | 1.568 | 4296 |
| J. Berda | 6.3 | 622 | 8 | 50 | 0.313 | 859 |
| Thar Souk | 12 | 445 | 8 | 36 | 0.428 | 1172 |
| Teroual | 6.1 | 480 | 6 | 29 | 0.176 | 481 |
| Ourtzagh | 15 | 526 | 6 | 32 | 0.473 | 1297 |
| Ain Saddine | 10 | 624 | 6 | 37 | 0.374 | 1025 |
| Taounate | 4 | 454 | 6 | 27 | 0.109 | 298 |
| Tissa | 5 | 337 | 6 | 20 | 0.101 | 277 |
| Jorf El Melha | 10 | 480 | 6 | 29 | 0.288 | 789 |
| Ain Defali | 12.0 | 587 | 6 | 35 | 0.423 | 1158 |
| Had Kourt | 6 | 499 | 6 | 30 | 0.180 | 492 |