# NATURAL RESOURCE ACCOUNTING: WATER ACCOUNTS OF THE UPPER VAAL WATER MANAGEMENT AREA 1991-2000

**Discussion Document**

# Interpretative summary

Statistics South Africa (Stats SA) implemented the 1993 System of National Accounts (SNA) in June 1999 in conjunction with rebasing and benchmarking of Gross Domestic Product (GDP) estimates. In addition, Stats SA also published the first set of supply and use tables (SU-tables). These tables were developed to include all the transactions in goods and services in the South African economy for a specific year in matrix format. The first set of these tables with 1993 as reference year were published in 1999. Subsequent tables were published for 1998 and 1999. As a next step towards implementing the 1993 SNA, Stats SA has now compiled Natural Resource Accounts (NRA) (satellite accounts) for minerals and water. Satellite accounts or systems (e.g. NRA) as presented in the 1993 SNA, generally stress the need to expand the analytical capacity of national accounting for selected areas of social concern in a flexible manner, without overburdening or disrupting the central system.

In this discussion document, the methodology (techniques and method used) with an example for the compilation of the water accounts is discussed. The actual accounts for the upper Vaal Water Management Area (WMA) form the basis for the discussion and these include supply, use as well as asset accounts. In future Stats SA aims to compile a full set (19 catchment areas) of water accounts for South Africa with an update every five years.

The most important conclusion to be drawn from this study is that it was possible to compile water resource accounts for the Upper Vaal WMA using the framework proposed by the United Nations. From the analysis of this WMA the following conclusions can be drawn with regard to the physical account.

Although many studies of the WMA have been done, some detailed data on the use of water remain unavailable or unreliable. In the case of the main water distributors, such as Rand Water Board, the data are reliable but where the distributors depend on local authorities to provide detailed user patterns, the data are unreliable. Specifically, data on groundwater use are also difficult to obtain and are not reliable.

As far as information on the supply of water is concerned, the Department of Water Affairs and Forestry's (DWAF) Data Management Unit has very reliable data available on the level of dams, outflow from dams and transfers in and out. These data are available on a daily or weekly basis.

If the erratic transfers to the Lower Vaal WMA are ignored, total use of water in the Upper Vaal WMA over the 10 year period 1991-2000 has increased from 1629,2 $Mm^3$ in 1991 to 2105,7 $Mm^3$ in 2000 with an average annual growth rate of 2,7 %. These calculations include the amount transferred to the Crocodile Catchment where the water was mostly used in the Tshwane Metropole and other urban areas.

Regarding the Surface Water Resources data a project is now underway to update the data from 1990 to 2000. The data used in these Water Research Commission of South Africa reports for annual runoff are therefore probably not the final figures and will be adapted by the project team consisting of a group of engineering firms.

The availability of the Lesotho Highlands Scheme since 1988 has pushed the total storage capacity of the Upper Vaal WMA up from 5618 to 8505 million $m^3$ and the potential annual transfer in from this scheme to the WMA up to 1500 million $m^3$.

In a water-scarce country, the provision of water should always be considered in terms of the socio-economic benefits accruing from contributions by specific users. Two macroeconomic variables were used as indicators of these benefits namely value added and employment opportunities. The total contribution to value added of water used per sector in 2000 amounted to R113,7 billion (in 2000 prices), while approximately 1,2 million employment opportunities are sustained by water use from the Upper Vaal River WMA for the same year.

According to the figures generated in this study, the cost to supply raw water was approximately R1 billion in 2000 while the revenue from water tariffs amounted to R1,6 billion. These figures translate into negative subsidies or overrecoveries of R544 million.

The compilation of water accounts requires extensive data. It is therefore very important that data should be available on a regular basis in order to facilitate analysis of supply and use trends. DWAF is the main supplier of data on water resource development and management. It is therefore of paramount importance that Stats SA and DWAF jointly plan and manage the collection and processing of water data to ensure that the data are available timeously and in the right format. The water resource accounts framework as proposed by the UN is very comprehensive and it requires very highly skilled people to compile reliable accounts. It is therefore important that the people who deal with these accounts in DWAF and Stats SA should be fully *au fait* with the nature and magnitude of water accounts.

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# 1. Introduction

Given the increasing international and local support for good environmental management based on sound economic principles, the need for Natural Resource Accounting (NRA) has become necessary. Over the past three to four decades the conventional System of National Accounts (SNA) has been the source of information about production and disposition of economic goods and services between intermediate use, final consumption and savings, about employment of primary factors of production (land, capital and labour) and the creation and distribution of income and wealth in national economies.

The central framework of the SNA presents a number of characteristics, which give it the advantage of an integrated accounting structure. It is exhaustive and consistent within the boundary of the economic activities it covers; that is, each unit, transaction, product and purpose is given a place, and only one, in the classifications and accounts of the System. Moreover, the set of concepts adopted by the System is fully coherent. The counterpart of these benefits is that there are certain limitations as to what may be accommodated directly in the central framework. Among the major shortcomings of the SNA is its focus on the production and the use of manufactured goods and assets that are bought and sold on the market. Excluding the values of environmental amenities, human capital and non-produced natural assets renders conventional measures of national income and wealth inappropriate for evaluating long-term welfa re aspects and sustainability.

Satellite accounts or systems (e.g. NRA) as presented in the 1993 SNA, generally stress the need to expand the analytical capacity of national accounting for selected areas of social concern in a flexible manner, without overburdening or disrupting the central system. On the one hand, satellite accounts are linked with the central framework of national accounts and through them to the main body of integrated economic statistics. On the other hand, as they are more specific to a given field or topic, they are also linked to the information system specific to this field or topic. They also call for better integration of monetary and physical data. Because they preserve close connections with the central accounts, they facilitate analyses of specific fields in the context of macro-economic accounts and analyses. Satellite accounts in various fields may, in addition, help to connect analyses between some of those fields. They are thus able to play a dual role, as tool for analyses and for statistical coordination.

Typically satellite accounts or systems allow for -

- The provision of additional information on particular social concerns of a functional or cross-sector nature;
- The use of complementary or alternative concepts, including the use of complementary and alternative classifications and accounting frameworks, when needed to introduce additional dimensions to the conceptual framework of national accounts;
- Extended coverage of costs and benefits of human activities;
- Further analysis of data by means of relevant indicators and aggregates; and
- Linkage of physical data sources and analysis to the monetary accounting system.

Statistics South Africa (Stats SA) has implemented the 1993 SNA in June 1999 in conjunction with rebasing and benchmarking of Gross Domestic Product (GDP) estimates. In addition, Stats SA also published the first set of supply and use tables (SU-tables), which intended to include all the transactions in goods and services in the South African economy for a specific year in matrix format, for the 1993 reference year in 1999. Subsequent tables were published for 1998 and 1999.

As a next step towards implementing the 1993 SNA, Stats SA has now compiled NRA (satellite accounts) for minerals and water.

The System for integrated Environmental and Economic Accounting (SEEA) was developed by the United Nations to provide a conceptual basis for implementing a 1993 SNA (satellite) system for integrated environmental and economic accounting. The SEEA describes the interrelationships between the natural environment and the economy. This is achieved by linking the conventional economic accounts with environmental and natural resource accounts. The main purpose of integrated environmental and economic accounting is to support integrated social, economic and environmental policy by means of an integrated information system. This facilitates policy-making and analysis of the interaction between environmentally sound and sustainable economic growth and development.

In this discussion document, the methodology (techniques and method used) with an example for the compilation of the water accounts is discussed. The actual accounts for the upper Vaal Water Management Area will form the basis for the discussion and these will include supply, use as well as the asset accounts. In future Stats SA aims to compile a full set (19 catchment areas) of water accounts for South Africa with an update every five years.

# 2. Methodology

## 2.1 Physical Accounts

The framework for water resource accounts in physical units is made up of the following components:

- *Water supply accounts.*
- *Water use accounts*
- *Water asset account.*

The basis of these accounts is formed by the structures as proposed in Chapter 7 of the Handbook on Integrated Environmental and Economic Accounting.

### 2.1.1 Water Supply Accounts

Table 1 on page 3 gives a schematic representation of the supply of water in terms of industries, final consumers, rest of the world and the environment.

**Table 1 - Schematic water supply table (millions of cubic metres)**

| *Sources* | | *Agriculture* | *Energy* | *Industries* | *Final Consumer* | *Rest of the World* | *Environment* | *Total* |
|---|---|---|---|---|---|---|---|---|
| **Ecosystem Inputs** | **S1** – Rain | | | | | | | |
| **Natural Resources** | **S2** –Total water abstracted | | | | | | | |
| | Water abstracted for own use of which: for irrigation | | | | | | | |
| | Water abstracted for delivery | | | | | | | |
| **Products** | **S3** – Water supplied to other sectors of which: Wastewater | | | | | | | |
| **Residuals** | **S4** -Water returned | | | | | | | |
| | Irrigation water | | | | | | | |
| | Cooling water | | | | | | | |
| | Wastewater treated | | | | | | | |
| | Wastewater untreated | | | | | | | |
| | Losses/leakages in distribution | | | | | | | |
| | Other returns | | | | | | | |
| **S**-Total Supply (S3 + S4) | | | | | | | | |

**Source: United Nations Statistical Division**

The following supply sources are used to compile the water supply table:

- Ecosystem Inputs (S1);
- Natural Resources (S2);
- Products (S3); and
- Residuals (S4).

*Ecosystem Inputs (*S1)
The rainwater is supplied to the environment.

*Natural Resources (*S2)
In this section all abstracted water is shown as coming from the environment. It is then disaggregated between ground, perennial or ephemeral surface water.

*Products (*S3)
This section shows the main industries supplying water as a product. In addition, some industries may supply water which has already been used in the production process to other industries and as such has lower quality water in their production process. The supply of water as a product is net of the leakages during transportation. These losses/leakages are considered as returns from the industry supplying the water.

*Residuals (*S4)
The entries under residuals cover the returns of water to the environment and include all the flows of water that are supplied by the industries and used by the environment. In South Africa, the term *return flows* is commonly used to indicate this water.

### 2.1.2 Water use accounts

Table 2 on page 4 gives a schematic representation of the use of the water by the different water using sectors. The users of water as a natural resource are shown by industry.

**Table 2 - Schematic use table for water (millions of cubic metres)**

| *Sources* | | *Agriculture* | *Energy* | *Industries* | *Final Consumer* | *Rest of the World* | *Environment* | *Total* |
|---|---|---|---|---|---|---|---|---|
| **Ecosystem Inputs** | **U1** – Rain | | | | | | | |
| **Natural Resources** | **U2** –Total water abstracted | | | | | | | |
| | Water abstracted for own use of which: for irrigation | | | | | | | |
| | Water abstracted for delivery | | | | | | | |
| **Products** | **U3** – Water delivered through mains of which: wastewater | | | | | | | |
| **Residuals** | **U4** - Water returned | | | | | | | |
| | Irrigation water | | | | | | | |
| | Cooling water | | | | | | | |
| | Wastewater Treated | | | | | | | |
| | Wastewater Untreated | | | | | | | |
| | Losses/leakages In distribution | | | | | | | |
| | Other returns | | | | | | | |
| **U-Total Water Use (U1 +U2 + U3)** | | | | | | | | |
| **CONSUMPTION (U-S)** | | | | | | | | |

**Source: United Nations Statistical Division**

The use of water can also be disaggregated by purpose depending on data availability and specific country needs. It can also be distinguished according to whether the water is reused in the production process, after having been treated to some extent, or whether it is directly supplied through mains. In some instances, other countries classify the use of water according to whether it is provided by bulk systems or rural systems.

Table 2 makes provision for the different sources from which users will draw water for consumption or distribution namely:

- Ecosystem inputs (U1);
- Natural resources (U2);
- Products (U3);
- Residual (U4)

***Ecosystem inputs (U1)***
These will be the activities that use rainwater or reduce run off. In South Africa at present, only three activities are seen as reducing runoff namely, Forestry; Alien plants and Dryland Sugar Cane.

***Natural Resources (U2)***
These sources will include water abstracted from rivers, lakes, dams and groundwater for own use or distribution. For instance in the case of irrigation, the user can himself abstract from the source or there could be an irrigation scheme which abstracts water and distributes it.

***Products (U3)***
This water is received from distributors.

***Residuals (U4)***
Water that is returned to the system by the different sectors (Return flows).

Total water consumption can be calculated from the Supply and Use Table for water. Water consumption is defined as the part of abstracted water which is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, consumed by man or livestock, or otherwise removed from freshwater resources. Water consumption is calculated for each sector as the difference between water use and water supply.

### 2.1.3 Water asset account

Asset accounts for water reflect how the stocks of water at the beginning of the accounting period are affected by transfers of water between the environment and internal hydrological systems to make up the stocks of water at the end of an accounting period.

Before embarking on the compilation of asset accounts for water, the definition of water stocks has to be clarified. For groundwater, reservoirs and lakes it is conceptually simple to measure such stocks. For rivers, the stock of water is not well defined due to the "flowing" nature of the resource. In order to maintain consistency with the other water resources, the stock of water in a river is measured as the volume of the riverbed. However, the volume of a riverbed is not a quantity of water in itself and is not a good measure of water stocks for ephemeral rivers in particular. Alternative measures are the annual runoff (AR) into the river or the mean annual runoff (MAR) in a country subject to a very large annual variation.

AR is the total volume of water that flows during a year, usually referring to the outflow of a drainage area or river basin. For perennial rivers, runoff is measured at the lowest point (downstream sometimes close to the estuary). Hence it represents the balance of all the flows which took place upstream in the river catchment. For rivers crossing national borders, the runoff may take place entirely or mainly outside the relevant country in which case it is the runoff at the point of entry to that country or exit from that country which is of interest.

MAR is defined as the average annual flow under natural conditions. This definition is dependent on the runoff regime for each river basin. Where the flow increases downstream, (it is at its highest level at the mouth of the river basin), MAR is defined at the river basin. Where the flow in the rivers decreases downstream (often with little or no outflow from the river basin), MAR is defined as the combined MAR of each of the major catchments in the river basin, calculated at the point where the flow is at its highest level and excluding runoff from upstream basins.

The use of AR or MAR as a measure of stock, however, presents problems in the compilation of the asset accounts as some of the flows in the table may already be included, depending on where the river flow is measured. In such a case, the flows in the asset account should be modified accordingly to avoid double counting.

It is important to note that the classification of water assets does not include water in the soil, vegetation, snow or ice. Thus, the asset accounts will measure the precipitation, which falls directly on rivers, lakes and reservoirs, and the part of the precipitation, which reaches surface and ground water. The runoffs to surface water and infiltration to groundwater are therefore net of evapotranspiration.

The opening and closing stocks represent the quantity of water, in cubic meters, at the beginning and end respectively of the accounting period. The changes in stocks during the accounting period can be caused by human activities (abstraction and return of water to the environment) and by natural processes (precipitation, evapotranspiration, natural inflows and outflows to other rivers, etc.).

Table 3 gives a schematic representation of the asset account for water for surface water, groundwater and other resources.

**Table 3 - Schematic asset account for water (millions of cubic metres)**

| *Sources* | | | *Surface Water* | | | *Ground* | *Other* | *Total* |
|---|---|---|---|---|---|---|---|---|
| | | | *Dams* | *Rivers* | *Lakes* | | | |
| **Opening Stocks** | | | | | | | | |
| **A1** | Abstraction (-) | Sustainable use | | | | | | |
| | | Runoff reduced | | | | | | |
| **A2** | Residuals (+) | Irrigation | | | | | | |
| | | Wastewater | | | | | | |
| **A3** | Precipitation (+) | | | | | | | |
| **A4** | Inflows (+) | | | | | | | |
| **A5** | Net natural transfers () | | | | | | | |
| **A6** | Evapotranspiration (-) | | | | | | | |
| **A7** | Outflows (-) | To other regions | | | | | | |
| | | To the sea | | | | | | |
| **A8** | Other Volume changes | Due to natural disaster | | | | | | |
| | | Discovery (+) | | | | | | |
| | | Others | | | | | | |
| **Closing Stocks** | | | | | | | | |

**Source: United Nations Statistical Division**

The detailed description of the table entries is as follows:
**Abstraction** (row A1) is the total volume of water abstracted in a year. A distinction is made between water abstracted and water that is used by runoff reducing agricultural activities.

**Residuals** (row A2) represent the total volume of water in the accounting period returned to the environment. The total return of water; (A2), has to be equal to the part of the supply (S5) in the supply table, which returns to surface and groundwater. When data are available, the returns of water can be disaggregated by type of water returned and represented by annual runoff.

**Precipitation** (row A3) is composed of all wet precipitation. When the category "water in soil" is not included in the table, the figures for precipitations are net of evapotranspiration. They represent the part of the total annual precipitation that reaches the lakes (directly), rivers (via runoff), reservoirs (directly), and groundwater (infiltration) but include the water that was used by alien plants, forestation and dry land sugar cane.

**Inflows** (row A4) represent the total volume of water in the accounting period that enters the relevant territory. For a river that enters that territory, the inflow is the total quantity at its entry point.

**Net natural transfers** (row A5) for a water resource is defined as the difference between the inflows to one type of water resource from all the others and the outflows from the same water resource to all the others.

**Evapotranspiration** (row A6) is the loss (in cubic metres) during the accounting period of the water resources due to the process of evapotranspiration.

**Outflows** (row A7) represent the volume of water that leaves the relevant territory during the accounting period. This flow could be disaggregated depending on whether the flow is to other territories or to the sea.

**Other changes in volume** (row A8) include all the changes in the stocks of water that are not specified elsewhere in table 3. This item can either be estimated or calculated directly. It is usually calculated as a difference between the closing and opening stocks and the entries in the table and is therefore a balancing item.

## 2.2 Example of the compilation of physical accounts for water

This section provides an example of a relatively easy system to highlight the principles involved in compiling supply, use and asset accounts for water.

### 2.2.1 Supply account for water

Table 4 on page 8 and table 5 on page 9 provide an example of water supply account.

## ıple of a water supply account

| | Sources | | Total agri-culture | Irrigation | Afforestation | Energy | Collection and distribution of water | Sewerage | Urban requirement | Rest of the World | Environn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A + B | A | B | C | D | E | F | G | H |
| | **S1** | Rain | 0 | | | | | | | | |
| | **S2** | Total Water Abstracted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | | - Water for own use | 0 | | | | | | | | |
| | | - Water for irrigation | | | | | | | | | |
| | | - Water abstracted for delivery | | | | | | | | | |
| | **S3** | Water supplied to other sectors | 8.0 | 8.0 | | | 247.0 | | 60.0 | | |
| | | - of which is waste water | 0.0 | | | | 60.0 | | | | |
| | **S4** | Water returned | 18.5 | 18.5 | 0.0 | 12.0 | 12.0 | 130.0 | 0.0 | 0.0 | |
| | | - Irrigation water | 11.4 | 11.4 | | | | | | | |
| | | - Cooling Water | 0.0 | | | 1.2 | | | | | |
| | | - Waste water treated | 0.0 | | | | | 60.0 | | | |
| | | - Waste water untreated | 0.0 | | | | | 70.0 | | | |
| | | - Losses/Leakages | 7.1 | 7.1 | | | 12.0 | | | | |
| **supply** | **S3+S4** | | 26.5 | 26.5 | 0.0 | 12.0 | 259.0 | 130.0 | 60.0 | 0.0 | |

**Table 5 - Explanation of table 4**

| *Cell (Row/ Column)* | *Amount of water in physical units (million $m^3$)* | *Description* |
|---|---|---|
| 1H | 110 | This number is drawn from the use table row 1: Total, representing the total rainwater used by the system. |
| 2H | 125 | This number is drawn from the use table representing the water abstracted from the natural resource. |
| 2.1H | 55 | Ditto |
| 3H | 259 | Ditto |
| 4A | 8 | Water abstracted with irrigation water and supplied to another sector. |
| 4D | 247 | Water delivered through mains to the different sectors. |
| 4.1D | 60 | Water delivered through mains that end up in the sewerage treating system. |
| 4F | 60 | This is the water flowing from Urban requirements into the sewerage system. |
| 5A | 11.4 | Irrigation water discharged into the system. |
| 6C | 1.2 | Water from the energy sector discharged into the system. |
| 6E | 60 | This is the treated water discharged by the sewerage system, either into the environment or available for recycling. |
| 8E | 70 | This is the water from the paved urban areas into the stormwater system and discharged untreated. |
| 9A | 7.1 | Irrigation water conveyance losses. |
| 9D | 12 | Losses/Leakages in the distribution system. |

### 2.2.2 Use account for water

Table 6 on page 10 and table 7 on page 11 provide an example of water use account.

## le of a water use account

| | Sources | Total agriculture | Irrigation | Afforestation | Energy | Collection and distribution of water | Sewerage | Urban requirement | Rest of the World | Env |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A + B | A | B | C | D | E | F | G | |
| **U1** | Rain | 40 | | 40 | | | 70 | | | |
| **U2** | Total Water Abstracted | 63 | 63 | | 62 | 259 | 0 | 0 | 0 | |
| | Water for own use | 63 | 63 | | 62 | | | | | |
| | of which for irrigation | 55 | 55 | | | | | | | |
| | :Water abstracted for delivery | | | | | 259 | | | | |
| **U3** | Water delivered through mains | 8 | 8 | | | | 60 | 182 | 65 | |
| | of which is waste water | | | | | | | 60 | | |
| **U4** | Water returned | | | | | | | | | |
| | Irrigation water | | | | | | | | | |
| | Cooling Water | | | | | | | | | |
| | Waste water treated | | | | | | | | | |
| | Waste water untreated | | | | | | | | | |
| | Losses/Leakages | | | | | | | | | |
| **U1+U2+U3** | | 111 | 71 | 40 | 62 | 259 | 130 | 182 | 65 | |
| | | 84.5 | 44.5 | 40.0 | 50.0 | 0.0 | 0.0 | 122.0 | 65.0 | |

**Table 7 - Explanation of table 6**

| *Cell (Row/ Column)* | *Amount of water in physical units (million $m^3$)* | *Description* |
|---|---|---|
| 1B | 40 | Water reduction/use by afforestation. South Africa at this stage only accepts afforestation, alien plants and dry land sugar cane as water reduction agriculture practices. |
| 1E | 70 | Rain water falling on paved urban areas and flowing into the stormwater system. |
| 2A | 63 | Water abstracted for irrigation (includes losses). |
| 2.1A | 55 | The portion of the water abstracted and effectively used for irrigation. |
| 2C | 62 | Water abstracted for electricity plants. |
| 3D | 259 | Water abstracted by water boards for further distribution. |
| 4A | 8 | Water abstracted by the irrigation system but delivered to another sector. |
| 4E | 60 | The water in the sewerage system delivered by the urban users. |
| 4F | 182 | Water delivered to the urban users. |
| 4G | 65 | Water delivered to users in another WMA. |
| 4.1F | 60 | Water used by urban users which ultimately flows into sewerage system |
| 5H | 11.4 | These numbers came from the same categories in the supply table and represents water discharged by the sectors into the environment. |
| 6H | 1.2 | |
| 7H | 60 | |
| 8H | 70 | |
| 9H | 19.1 | |

### 2.2.3 Asset Account for Water

The following table 8 represents a water asset account which is compiled only for water storage facilities.

**Table 8 - Example of a water asset account (millions of cubic metres)**

| | | | *Surface water, dams and other storage facilities* | *Groundwater* | *Total* |
|---|---|---|---|---|---|
| | | | A | B | C |
| 1 | Opening stock (as at 1st of October 1999) | + | 480 | | 480 |
| 2 | Abstraction | - | 384 | | 384 |
| | Total return flows | + | 153.4 | | 153.4 |
| 3 | Return flows:- Irrigation water | | 11.4 | | 11.4 |
| 4 | Cooling water | | 12 | | 12 |
| | Waste water | | | | |
| 5 | Treated | | 60 | | 60 |
| | Waste water | | | | |
| 6 | Untreated | | 70 | | 70 |
| 7 | Other returns | | | | 0 |
| 8 | Precipitation (Annual run off) | + | 700 | | 700 |
| | Total transfers in | + | 32 | | 32 |
| | Transfers in:Lesotho | | | | |
| 9 | Highlands | | 20 | | |
| 10 | Tugela | | 12 | | |
| 11 | Net natural transfers | (+\-) | | | 0 |
| 12 | Evapotranspiration | - | 51 | | 51 |
| | Total transfers out | - | 66 | | 66 |
| 13 | Transfers out: Olifants | | 29 | | |
| 14 | Flood releases | | 37 | | |
| | Total volume change | + | -65 | | -65 |
| | Other volume changes | | | | |
| | Due to natural disasters | | | | |
| | Other (balancing item) | | | | |
| 15 | | | -65 | | -65 |
| | Closing stock (30 September 2000) | | 799.4 | 0 | 799.4 |

**Table 9 - Explanation of table 8**

| *Cell (Row/ Column)* | *Amount of water in physical units (million $m^3$)* | *Description* |
|---|---|---|
| 1A | 480 | Measured opening volumes in the water storage facilities. |
| 2A | 384 | Water abstracted from Natural Resources Use Accounts. |
| 3A | 11.4 | Irrigation water return flows from the Supply Account. |
| 4A | 12 | Cooling water return flows from the Supply Account. |
| 5A | 60 | Treated waste water returned from the Supply Account. |
| 6A | 70 | Untreated waste water from the stormwater system – from the Supply Account. |
| 7A | - | Other return flows from the Supply Account. |
| 8A | 700 | Annual nett runoff in the rivers actually reaching the storage facilities. |
| 9A | 20 | Water transferred in from the Lesotho Highlands. |
| 10A | 12 | Water transferred in from the Tugela pump scheme. |
| 11A | - | This represents water that flows into the storage facilities and flows out. If there is a residual it is refl ected. |
| 12A | 51 | Evaporation and storage losses. |
| 13A | 29 | Transfers to the Olifants WMA. |
| 14A | 37 | The storage facilities/dams were full and the water flowed to the sea or another WMA. |
| 15A | 65 | Water volumes are difficult to balance. This is therefore used to balance the calculated closing stock with actual measured closing stock. This is done to ensure that at the beginning of every year/period, the asset account starts with the correct volumes. |

# 3. Physical Water Accounts for the Upper Vaal River Catchment Area

The supply, use and asset accounts for the Upper Vaal River Catchment are founded on a comprehensive database from which the appropriate figures are entered into the accounts.

The database combines data from three main sources namely:

- Department of Water Affairs and Forestry - The National Water Resources Strategy Proposed First Edition, October 2001.
- BKS (Pty) Ltd - Upper Vaal Management Area: Water Resources Situation assessment Main Report (Volume 1 of 3)
- Department of Water Affairs and Forestry - Comprehensive unpublished data received from the Hydrological Data Management Unit

Data from the Department of Water Affairs and Forestry could only be obtained for 1995, the average growth rate between 1995 and 2000 was therefore calculated and extrapolated to the years preceding 1995

## 3.1 Water supply accounts: 1991 - 2000

This section contains annual water supply accounts for the Upper Vaal WMA for 1991 to 2000. The accounts will be followed by a summary table with a short discussion.

## supply in the Upper Vaal Water Management Area 1991 (millions of cubic metre)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORSTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | OF IRRIGATION DISTRIBUTION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | RAIN (S1) | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 938.2 | 0.0 | 160.2 | 121.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 160.2 | 121.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 113.7 | 392.7 | 0.0 | 0.0 | 0.0 |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 281.3 | 0.0 | 0.0 | 0.0 |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 113.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | (S3 + S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1051.9 | 392.7 | 160.2 | 121.0 | 0.0 |

er use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

s represents water used in urban areas for light industries and parks but excludes domestic requirements

represents domestic use and stock watering.

## ply in the Upper Vaal Water Management Area for 1992 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN (S1) | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 980.7 | 0.0 | 164.8 | 124.4 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 164.8 | 124.4 | 0.0 | |
| | | | | | | | | | | | | | | | |
| | WATER RETURNED ( WATER DISCHARGED ) (S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 117.0 | 400.8 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 289.3 | 0.0 | 0.0 | 0.0 | |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 | |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 117.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1097.7 | 400.8 | 164.8 | 124.4 | 0.0 | |

represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

sents water used in urban areas for light industries and parks but excludes domestic requirements

ents domestic use and stock watering.

## upply in the Upper Vaal Water Management Area for 1993 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| | 1 | RAIN (S1) | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | | | | | | | | | | | | | | |
| | 2.1 | - of which for irrigation | | | | | | | | | | | | | | |
| | 3 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | | GROUNDWATER | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | | | | | | | | | | | | | | |
| | 4.1 | - of which for irrigation | | | | | | | | | | | | | | |
| | 5 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1025.6 | 0.0 | 169.6 | 128.0 | 0.0 | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 169.6 | 128.0 | 0.0 | |
| | | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 120.3 | 409.0 | 0.0 | 0.0 | 0.0 | |
| | 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 297.6 | 0.0 | 0.0 | 0.0 | |
| | 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 | |
| | 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 120.3 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | (S3 + S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1145.9 | 409.0 | 169.6 | 128.0 | 0.0 | |

use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

epresents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

## upply in the Upper Vaal Water Management Area for 1994 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | I ( W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| 1 | RAIN (S1) | | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1073.0 | | 0.0 | 174.4 | 131.7 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 174.4 | 131.7 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 123.7 | | 417.5 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 306.1 | 0.0 | 0.0 | 0.0 | |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 | |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 123.7 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 1196.8 | | 417.5 | 174.4 | 131.7 | 0.0 | |

use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

epresents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

## pply in the Upper Vaal Water Management Area for 1995 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| | | | | | | | | | | | | | | | | |
| 1 | RAIN (S1) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1123.2 | | 0.0 | 179.4 | 135.4 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 179.4 | 135.4 | 0.0 |
| | | | | | | | | | | | | | | | | |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 127.2 | | 426.3 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 314.9 | 0.0 | 0.0 | 0.0 |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 127.2 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | |
| | (S3+S4)` | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 1250.4 | | 426.3 | 179.4 | 135.4 | 0.0 |

e represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

resents water used in urban areas for light industries and parks but excludes domestic requirements

esents domestic use and stock watering.

## supply in the Upper Vaal Water Management Area for 1996 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| | 1 | RAIN (S1) | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | | | | | | | | | | | | | | |
| | 2.1 | - of which for irrigation | | | | | | | | | | | | | | |
| | 3 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | | GROUNDWATER | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | | | | | | | | | | | | | | |
| | 4.1 | - of which for irrigation | | | | | | | | | | | | | | |
| | 5 | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1173.3 | 0.0 | 184.4 | 139.2 | 0.0 | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 184.4 | 139.2 | 0.0 | |
| | | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 130.8 | 435.0 | 0.0 | 0.0 | 0.0 | |
| | 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 323.6 | 0.0 | 0.0 | 0.0 | |
| | 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 | |
| | 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 130.8 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1304.1 | 435.0 | 184.4 | 139.2 | 0.0 | |

er use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

s represents water used in urban areas for light industries and parks but excludes domestic requirements

represents domestic use and stock watering.

## supply in the Upper Vaal Water Management Area for 1997 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| 1 | RAIN (S1) | | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1226.1 | | 0. 0 | 189.5 | 143.0 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 189.5 | 143.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 134.4 | | 444.0 | 0.0 | 0.0 | 0.0 | |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 332.6 | 0.0 | 0.0 | 0.0 | |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 | |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 134.4 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 1360.5 | | 444.0 | 189.5 | 143.0 | 0.0 | |

er use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

s represents water used in urban areas for light industries and parks but excludes domestic requirements

s represents domestic use and stock watering.

## ' supply in the Upper Vaal Water Management Area for 1998 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF WATER | IRRIGATION OF WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | REST THE WORI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | | I | J | K | L | M |
| 1 | RAIN (S1) | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1281.8 | | 0.0 | 194.8 | 147.0 | 0.0 | 0.( |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 194.8 | 147.0 | 0.0 | 0.( |
| | WATER RE TURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 138.1 | | 453.3 | 0.0 | 0.0 | 0.0 | 0.( |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 341.9 | 0.0 | 0.0 | 0.0 | 0.( |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 | 0.( |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 138.1 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1419.9 | | 453.3 | 194.8 | 147.0 | 0.0 | 0.( |

r use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

represents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

## supply in the Upper Vaal Water Management Area for 1999 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| 1 | RAIN (S1) | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 2.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 3 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | | | | | | | | | | | | | | | |
| 4.1 | - of which for irrigation | | | | | | | | | | | | | | | |
| 5 | - Water abstracted for delivery | | | | | | | | | | | | | | | |
| 6 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1340.5 | | 0.0 | 200.2 | 151.1 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 200.2 | 151.1 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 141.9 | | 462.8 | 0.0 | 0.0 | 0.0 |
| 7 | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 351.4 | 0.0 | 0.0 | 0.0 |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 |
| 11 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 141.9 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | | 1482.4 | | 462.8 | 200.2 | 151.1 | 0.0 |

er use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

s represents water used in urban areas for light industries and parks but excludes domestic requirements

s represents domestic use and stock watering.

## pply in the Upper Vaal Water Management Area for 2000 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | R C V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| | RAIN (S1) | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (S2) | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | | | | | | | | | | | | | | |
| | - Water abstracted for own use | | | | | | | | | | | | | | |
| 1 | - of which for irrigation | | | | | | | | | | | | | | |
| | - Water abstracted for delivery | | | | | | | | | | | | | | |
| | GROUNDWATER | | | | | | | | | | | | | | |
| | - Water abstracted for own use | | | | | | | | | | | | | | |
| 1 | - of which for irrigation | | | | | | | | | | | | | | |
| | - Water abstracted for delivery | | | | | | | | | | | | | | |
| 5 | WATER SUPPLIED TO OTHER SECTORS (S3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1402.3 | 0.0 | 205.8 | 155.3 | 0.0 | |
| 1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 205.8 | 155.3 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED )(S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 145.9 | 472.6 | 0.0 | 0.0 | 0.0 | |
| | - Irrigation water | 11.4 | 11.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 361.1 | 0.0 | 0.0 | 0.0 | |
| 0 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 | |
| 1 | - Losses/leakages | 14.6 | 14.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.9 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | (S3+S4) | 26.0 | 26.0 | 0.0 | 0.0 | 0.0 | 0.0 | 145.7 | 0.0 | 1548.2 | 472.6 | 205.8 | 155.3 | 0.0 | |

e represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

resents water used in urban areas for light industries and parks but excludes domestic requirements

resents domestic use and stock watering.

**Table 20 - Return flows for the Upper Vaal River Catchment area (1991 – 2000) in $Mm^{3)}$**

| *Year* | *Return flows* |
|---|---|
| 1991 | 678,1 |
| 1992 | 689,4 |
| 1993 | 701,0 |
| 1994 | 712,9 |
| 1995 | 725,2 |
| 1996 | 737,4 |
| 1997 | 750,1 |
| 1998 | 763,0 |
| 1999 | 776,3 |
| 2000 | 790,0 |

**Source: Statistics South Africa**

Return flows from paved urban areas remained constant at 111,4 $Mm^3$ between table 21 on page 26 and table 30 on page 35 despite the fact that the size of the paved areas in practice is steadily increasing. Table 20 (p. ) indicates that return flows increase in relation to the level of water usage over the study period, 1991-2000.

## 3.2 Water use accounts: 1991 - 2000

This section contains the annual water use accounts for the Upper Vaal WMA from 1991 to 2000. The accounts are followed by a summary table with a short discussion.

## ıse in the Upper Vaal Water Management Area for 1991 (millions of cubic metres)

| | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| RAIN (U1) | 30. 3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 67.5 | 173.3 | 0.0 | 1045.9 | 0.0 | 6.4 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 67.5 | 173.3 | 0.0 | 1042.2 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 67.5 | 173.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 1 - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1042.2 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | 0.0 | 6.4 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 0.0 | 0.0 | |
| 1 - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | |
| WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 281.3 | 315.6 | 192.5 | 3.7 | |
| 1 - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 281.3 | 0 | 0 | 0.0 | |
| | | | | | | | | | | | | | | |
| WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| - Irrigation water | | | | | | | | | | | | | | |
| - Cooling water | | | | | | | | | | | | | | |
| - Wastewater treated | | | | | | | | | | | | | | |
| ) - Wastewater untreated | | | | | | | | | | | | | | |
| 1 - Losses/leakages | | | | | | | | | | | | | | |
| 2 - Other returns | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 67.5 | 173.3 | 0.0 | 1045.9 | 392.7 | 322.0 | 192.5 | 3.7 | |
| | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 67.5 | 27.7 | 0.0 | -6.0 | 0.0 | 161.8 | 71.5 | 3.7 | |

use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

epresents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

## ıter use in the Upper Vaal Water Management Area for 1992 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RU L RE IRI EN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B +C | A | B | C | D | E | F | G | H | | I | J | K | L | |
| ; | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 111.4 | 0.0 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| ES | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 68.8 | 173.3 | 0.0 | 1093.6 | | 0.0 | 6.3 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 68.8 | 173.3 | 0.0 | 1089.9 | | 0.0 | 0.0 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 68.8 | 173.3 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0. | |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0. | |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1089.9 | | 0.0 | 0.0 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | | 0.0 | 6.3 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 6.3 | 0.0 | 0. | |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0. | |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | | 0.0 | 0.0 | 0.0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 289.3 | 321.0 | 201.0 | 3. | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 289.3 | 0 | 0 | 0. | |
| | | | | | | | | | | | | | | | | | |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 68.8 | 173.3 | 0.0 | 1093.6 | | 400.8 | 327.3 | 201.0 | 3. | |
| S) | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 68.8 | 27.7 | 0.0 | -4.0 | | 0.0 | 162.5 | 76.5 | 3. | |

al water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ements represents water used in urban areas for light industries and parks but excludes domestic requirements

ements represents domestic use and stock watering.

## ıse in the Upper Vaal Water Management Area for 1993 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RU RE EM S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | | H | | I | J | K | |
| 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 70.1 | 173.3 | 0.0 | | 1143.5 | | 0.0 | 6.2 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 70.1 | 173.3 | 0.0 | | 1139.8 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 70.1 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1139.8 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 6.2 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 6.2 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | |
| 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 297.6 | 326.5 | 209.9 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 297.6 | 0 | 0 | |
| | | | | | | | | | | | | | | | | |
| | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 70.1 | 173.3 | 0.0 | | 1143.5 | | 409.0 | 332.7 | 209.9 | |
| | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 70.1 | 27.7 | 0.0 | | -2.4 | | 0.0 | 163.2 | 81.9 | |

use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

epresents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1994 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RU RE IRI EN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B +C | A | B | C | D | E | F | G | | H | | I | J | K | |
| | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 71.4 | 173.3 | 0.0 | | 1195.7 | | 0.0 | 6.2 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 71.4 | 173.3 | 0.0 | | 1192.0 | | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 71.4 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0. |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0. |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1192.0 | | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| 1 | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 6.2 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 6.2 | 0.0 | 0. |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0. |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 306.1 | 332.1 | 219.2 | 3. |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 306.1 | 0 | 0 | 0. |
| | | | | | | | | | | | | | | | | | |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 71.4 | 173.3 | 0.0 | | 1195.7 | | 417.5 | 338.2 | 219.2 | 3. |
| | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 71.4 | 27.7 | 0.0 | | -1.0 | | 0.0 | 163.8 | 87.5 | 3. |

water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

ents represents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1995 (millions of cubic metres)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF WATER | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 72.8 | 173.3 | 0.0 | | 1250.3 | | 0.0 | 6.1 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 72.8 | 173.3 | 0.0 | | 1246.6 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 72.8 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1246.6 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 6.1 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 6.1 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 314.9 | 337.7 | 228.9 | 3.7 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 314.9 | 0 | 0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | |
| | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 72.8 | 173.3 | 0.0 | | 1250.3 | | 426.3 | 343.8 | 228.9 | 3.7 |
| | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 72.8 | 27.7 | 0.0 | | -0.1 | | 0.0 | 164.4 | 93.5 | 3.7 |

water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

nts represents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1996 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RUL REIREN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L |
| | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 111.4 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 74.2 | 173.3 | 0.0 | 1304.9 | 0.0 | 6.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 74.2 | 173.3 | 0.0 | 1301.2 | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 74.2 | 173.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1301.2 | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | 0.0 | 6.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0. |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.7 | 0.0 | 0.0 | 0.0 | 0. |
| | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 323.6 | 343.4 | 238.6 | 3. |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 323.6 | 0 | 0 | 0. |
| | | | | | | | | | | | | | | | |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 74.2 | 173.3 | 0.0 | 1304.9 | 435.0 | 349.4 | 238.6 | 3. |
| | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 74.2 | 27.7 | 0.0 | 0.8 | 0.0 | 165.0 | 99.5 | 3. |

water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

ents represents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1997 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | I I I I I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | |
| | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 75.5 | 173.3 | 0.0 | | 1361.9 | | 0.0 | 5.9 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 75.5 | 173.3 | 0.0 | | 1358.2 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 75.5 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1358.2 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 5.9 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.9 | 0.0 | |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 332.6 | 349.2 | 248.8 | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 332.6 | 0 | 0 | |
| | | | | | | | | | | | | | | | | | |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 75.5 | 173.3 | 0.0 | | 1361.9 | | 444.0 | 355.1 | 248.8 | |
| | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 75.5 | 27.7 | 0.0 | | 1.3 | | 0.0 | 165.6 | 105.7 | |

water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

ents represents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1998 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RU RE EM S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | |
| | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| ; | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 77.0 | 173.3 | 0.0 | | 1421.3 | | 0.0 | 5.8 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 77.0 | 173.3 | 0.0 | | 1417.6 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 77.0 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1417.6 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 5.8 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.8 | 0.0 | |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 341.9 | 355.1 | 259.3 | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 341.9 | 0 | 0 | |
| | | | | | | | | | | | | | | | | | |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 77.0 | 173.3 | 0.0 | | 1421.3 | | 453.3 | 360.9 | 259.3 | |
| | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 77.0 | 27.7 | 0.0 | | 1.4 | | 0.0 | 166.1 | 112.3 | |

vater use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

ents represents domestic use and stock watering.

## er use in the Upper Vaal Water Management Area for 1999 (millions of cubic metres)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| | 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 |
| | | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 78.4 | 173.3 | 0.0 | | 1483.4 | | 0.0 | 5.7 | 0.0 | 0.0 |
| | | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 78.4 | 173.3 | 0.0 | | 1479.7 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 78.4 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1479.7 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 5.7 | 0.0 | 0.0 |
| | 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.7 | 0.0 | 0.0 |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 351.4 | 361.0 | 270.3 | 3.7 |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 351.4 | 0 | 0 | 0.0 |
| | | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 78.4 | 173.3 | 0.0 | | 1483.4 | | 462.8 | 366.8 | 270.3 | 3.7 |
| | | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 78.4 | 27.7 | 0.0 | | 1.0 | | 0.0 | 166.6 | 119.2 | 3.7 |

water use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

ents represents water used in urban areas for light industries and parks but excludes domestic requirements

nts represents domestic use and stock watering.

## ıse in the Upper Vaal Water Management Area for 2000 (millions of cubic metres)

| | | TOTAL AGRICUL-TURE | IRRIGATION AGRICUL-TURE | LIVESTOCK | AFFORESTA-TION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIB U-TION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSE-HOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| 1 | RAIN (U1) | 30.3 | 0.0 | 0.0 | 30.3 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 111.4 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED (U2) | 150.7 | 113.8 | 36.9 | 0.0 | 0.0 | 79.9 | 173.3 | 0.0 | | 1548.2 | | 0.0 | 5.7 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 79.9 | 173.3 | 0.0 | | 1544.5 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 79.9 | 173.3 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 113.8 | 113.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 1544.5 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 5.7 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 36.9 | 0.0 | 36.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.7 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 3.7 | | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS (U3) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 361.1 | 367.1 | 281.8 | 3.7 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 361.1 | 0 | 0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) (U4) | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | |
| | (U1+U2+U3) | 181.0 | 113.8 | 36.9 | 30.3 | 0.0 | 79.9 | 173.3 | 0.0 | | 1548.2 | | 472.6 | 372.8 | 281.8 | 3.7 |
| | | 155.0 | 87.8 | 36.9 | 30.3 | 0.0 | 79.9 | 27.7 | 0.0 | | 0.0 | | 0.0 | 167.0 | 126.5 | 3.7 |

use represents users such as Iscor,Sappi,Sasol and other large industries outside the municipal areas.

epresents water used in urban areas for light industries and parks but excludes domestic requirements

epresents domestic use and stock watering.

### 3.2.1 Surface water use

Table 31 provides a summary of the water use tables for the Vaal River Catchment area from 1991 to 2000.

**Table 31 – Surface water use and transfers out 1991-2000 (million cubic metres)**

| *Year* | *Agriculture* | *Energy* | *Mining & Heavy Industry* | *Urban: Domestic* | *Urban: Other* | *Transfers out: Crocodile* | *Transfers out: Other* | *Ecological* | *Total* |
|---|---|---|---|---|---|---|---|---|---|
| 1991 | 150.7 | 67.5 | 173.3 | 315.6 | 192.5 | 426.4 | 578.7 | 299.5 | 2 204.2 |
| 1992 | 150.7 | 68.8 | 173.3 | 321.0 | 201.0 | 455.0 | 629.6 | 299.5 | 2 298.9 |
| 1993 | 150.7 | 70.1 | 173.3 | 326.5 | 209.9 | 485.5 | 697.6 | 299.5 | 2 413.1 |
| 1994 | 150.7 | 71.4 | 173.3 | 332.1 | 219.2 | 518.1 | 646.4 | 299.5 | 2 228.7 |
| 1995 | 150.7 | 72.8 | 173.3 | 337.7 | 228.9 | 552.8 | 929.6 | 299.5 | 2 745.3 |
| 1996 | 150.7 | 74.2 | 173.3 | 343.4 | 238.6 | 587.5 | 777.1 | 299.5 | 2 644.3 |
| 1997 | 150.7 | 75.5 | 173.3 | 349.2 | 248.8 | 624.5 | 668.8 | 299.5 | 2 590.3 |
| 1998 | 150.7 | 77.0 | 173.3 | 355.1 | 259.3 | 663.7 | 834.5 | 299.5 | 2 813.1 |
| 1999 | 150.7 | 78.4 | 173.3 | 361.0 | 270.3 | 705.4 | 953.1 | 299.5 | 2 991.7 |
| 2000 | 150.7 | 79.9 | 173.3 | 367.1 | 281.8 | 749.7 | 801.7 | 299.5 | 2 903.7 |

**Source: Statistics South Africa**

It is important to note that the Upper Vaal WMA is managed as an integrated unit by the DWAF. The water supply to this WMA is also linked to the Tugela Pump System and the Lesotho Highlands Water Scheme. This WMA not only delivers water to its specific area but also delivers large amounts of water to the Crocodile WMA and the Lower Vaal WMA.

The amount of water used by the Agricultural sector remained the same between 1991 and 2000 as indicated in table 31 because no new irrigation schemes were allowed by DWAF over this period. Also no new afforestation was issued permits in the WMA.

Although there seems to be a small growth in the energy sector, indications are that no new electricity generation plants are to be constructed in this WMA.

The volume of water transferred in the Upper Vaal River to the Middle Vaal WMA (Transfers out) depends on the rainfall during the rain season and the volume available in the Bloemhof dam. This volume therefore appears to be very erratic.

If the sporadic transfers to the Lower Vaal WMA are ignored, the total use of water showed a steady growth over the 10 year period from 1625,5 $Mm^3$ in 1991 to 2102 $Mm^3$ in 2000 (table 31, p.), an increase of 29,3 % which represents an average annual growth rate of 2,9 %.

### 3.2.2 Groundwater use

Groundwater is mostly used by rural communities for domestic use and for animal drinking. Data is not readily available but it is generally accepted that the use of groundwater is not really expanding because the livestock sub-sector is not expanding and rural farm populations are decreasing

**Table 32 - Average groundwater use (millions of cubic metres)**

| *Year* | *Rural Domestic* | *Rural Livestock* | *Rural Households* | *Total* |
|---|---|---|---|---|
| 1991-2000 | 5,7 | 36,9 | 3,7 | 46,3 |

**Source: Statistics South Africa**

Note: Rural Households represents a groundwater scheme in the Zuurbekom area delivering groundwater to a semi rural area.

## 3.3 Water asset accounts: 1991-2000

This section contains the annual asset accounts for the Upper Vaal WMA for the relevant 10-year period. A summary table with a short discussion follows these accounts.

## set account for water resources in the Upper Vaal Water Management Area for 1991 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUND |
| | | A | B + C | B | C | D |
| CK [ AS AT 1st OCTOBER 1990 ] | | 4819.34 | 0 | | | 296. |
| N | Sustainable use ( - ) | 1396.8 | 0 | | | 47. |
| | : of which Crocodile WMA transfer | 541.0 | | | | |
| | Depletion of groundwater stocks | | | | | |
| RN FLOWS | ( + ) | 549.8 | 0 | 0.0 | 0.0 | 0. |
| WS / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 281.3 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ON ( ANNUAL RUN OFF ) | ( + ) | 1345.2 | 0 | | | 47. |
| SFERS IN | ( + ) | 468.5 | 0.0 | 0.0 | 0.0 | 0. |
| N | - Tugela - Sterkfontein | 351.7 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| L TRANSFERS | ( +\- ) | | | | | |
| PIRATION ( - ) | | 409.0 | 0.0 | | | |
| SFERS OUT | ( - ) | 878.2 | 0 | 0 | 0 | 0 |
| UT | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 543.0 | | | | |
| | - Flood release | 0.0 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| ME CHANGE | ( + ) | 709.7 | 0 | 0 | 0 | 0 |
| ME CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 709.7 | | | | |
| CK [as at 30 September 1991] | | 4667.5 | 0.0 | 0.0 | 0.0 | 296. |

## account for water resources in the Upper Vaal Water Management Area for 1992 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUND |
| | | A | B + C | B | C | D |
| K [ AS AT 1st OCTOBER 1991 ] | | 4667.49 | 0 | | | 296. |
| | Sustainable use ( - ) | 1445.8 | 0 | | | 46. |
| | : of which Crocodile WMA transfer | 561.4 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 557.8 | 0 | 0.0 | 0.0 | 0.( |
| S / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 289.3 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 326.6 | 0 | | | 46. |
| ERS IN | ( + ) | 432.7 | 0.0 | 0.0 | 0.0 | 0.( |
| | - Tugela - Sterkfontein | 315.9 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION ( - ) | | 409.1 | 0.0 | | | |
| ERS OUT | ( - ) | 929.1 | 0 | 0 | 0 | 0 |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 593.9 | | | | |
| | - Flood release | 0.0 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 699 | 0 | 0 | 0 | 0 |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 699 | | | | |
| K [as at 30 September 1992] | | 3338.2 | 0.0 | 0.0 | 0.0 | 296. |

## account for water resources in the Upper Vaal Water Management Area for 1993 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNI |
| | | A | B + C | B | C | I |
| K [ AS AT 1st OCTOBER 1992 ] | | 3338.22 | 0 | | | 29 |
| | Sustainable use ( - ) | 1497.0 | 0 | | | 4( |
| | : of which Crocodile WMA transfer | 582.6 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 566.1 | 0 | 0.0 | 0.0 | 0 |
| / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 297.6 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 688.1 | 0 | | | 4( |
| ERS IN | ( + ) | 638.9 | 0.0 | 0.0 | 0.0 | 0 |
| | - Tugela - Sterkfontein | 522.1 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION ( - ) | | 409.1 | 0.0 | | | |
| ERS OUT | ( - ) | 997.1 | 0 | 0 | 0 | ( |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 661.9 | | | | |
| | - Flood release | 0.0 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 741.6 | 0 | 0 | 0 | ( |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 741.6 | | | | |
| K [as at 30 September 1993] | | 2487.1 | 0.0 | 0.0 | 0.0 | 29 |

## account for water resources in the Upper Vval Water Management Area for 1994 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNI |
| | | A | B + C | B | C | I |
| AS AT 1st OCTOBER 1993 ] | | 2487.03 | 0 | | | 29 |
| | Sustainable use ( - ) | 1550.5 | 0 | | | 4( |
| | : of which Crocodile WMA transfer | 604.5 | | | | |
| | Depletion of groundwater stocks | | | | | |
| LOWS | ( + ) | 574.6 | 0 | 0.0 | 0.0 | 0 |
| RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 306.1 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ANNUAL RUN OFF ) | ( + ) | 2220.6 | 0 | | | 4( |
| RS IN | ( + ) | 634.0 | 0.0 | 0.0 | 0.0 | 0 |
| | - Tugela - Sterkfontein | 517.2 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| ANSFERS | ( +\- ) | | | | | |
| ATION ( - ) | | 409.2 | 0.0 | | | |
| S OUT | ( - ) | 763.8 | 0 | 0 | 0 | ( |
| | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 428.7 | | | | |
| | - Flood release | 0.0 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| CHANGE | ( + ) | 826.3 | 0 | 0 | 0 | ( |
| CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 826.3 | | | | |
| as at 30 September 1994] | | 3414.5 | 0.0 | 0.0 | 0.0 | 29 |

## account for water resources in the Upper Vaal Water Management Area for 1995 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNDW |
| | | A | B + C | B | C | D |
| K [ AS AT 1st OCTOBER 1994 ] | | 3414.49 | 0 | | | 296.7 |
| | Sustainable use ( - ) | 1606.5 | 0 | | | 46.7 |
| | : of which Crocodile WMA transfer | 627.3 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 583.3 | 0 | 0.0 | 0.0 | 0.0 |
| / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 314.9 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 662.6 | 0 | | | 46.7 |
| ERS IN | ( + ) | 630.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Tugela - Sterkfontein | 513.2 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION | ( - ) | 409.2 | 0.0 | | | |
| ERS OUT | ( - ) | 1229.1 | 0 | 0 | 0 | 0 |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 893.9 | | | | |
| | - Flood release | 0.0 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 788.4 | 0 | 0 | 0 | 0 |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 788.4 | | | | |
| K [as at 30 September 1995] | | 2206.7 | 0.0 | 0.0 | 0.0 | 296.7 |

## :count for water resources in the Upper Vaal Water Management Area for 1996 (millions of cubic metres)

| | | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|---|
| | | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUN |
| | | | A | B + C | B | C | |
| AS AT 1st OCTOBER 1995 ] | | | 2206.73 | 0 | | | 29 |
| | Sustainable use | ( - ) | 1662.4 | 0 | | | 4 |
| | : of which Crocodile WMA transfer | | 650.1 | | | | |
| | Depletion of groundwater stocks | | | | | | |
| LOWS | | ( + ) | 592.1 | 0 | 0.0 | 0.0 | 0 |
| RESIDUALS | Irrigation water | | 11.4 | 0 | | | |
| | Cooling water | | 0.0 | 0 | | | |
| | Wastewater treated | | 323.6 | 0 | | | |
| | Wastewater untreated | | 257.1 | 0 | | | |
| | Other returns | | 0.0 | 0 | | | |
| ANNUAL RUN OFF ) | | ( + ) | 9423.1 | 0 | | | 4 |
| S IN | | ( + ) | 646.6 | 0.0 | 0.0 | 0.0 | 0 |
| | - Tugela - Sterkfontein | | 529.8 | | | | |
| | - Usuthu | | 116.8 | | | | |
| | - Lesotho Highlands | | | | | | |
| ANSFERS | | ( +\- ) | | | | | |
| ATION | | ( - ) | 409.2 | 0.0 | | | |
| S OUT | | ( - ) | 6575.4 | 0 | 0 | 0 | |
| | - Olifants | | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | | |
| | - Middle Vaal | | 741.4 | | | | |
| | - Flood release | | 5498.8 | | | | |
| | - Ecological Reserve | | 299.5 | | | | |
| CHANGE | | ( + ) | 928.6 | 0 | 0 | 0 | |
| CHANGES | Due to natural disaster | | | | | | |
| | Discovery | | | | | | |
| | Others | | 928.6 | | | | |
| as at 30 September 1996] | | | 4500.0 | 0.0 | 0.0 | 0.0 | 29 |

## account for water resources in the Upper Vval Water Management Area for 1997 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNDW |
| | | A | B + C | B | C | D |
| AS AT 1st OCTOBER 1996 ] | | 4499.98 | 0 | | | 296.7 |
| | Sustainable use ( - ) | 1720.8 | 0 | | | 46.5 |
| | : of which Crocodile WMA transfer | 673.7 | | | | |
| | Depletion of groundwater stocks | | | | | |
| LOWS | ( + ) | 601.1 | 0 | 0.0 | 0.0 | 0.0 |
| RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 332.6 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ANNUAL RUN OFF ) | ( + ) | 5009.5 | 0 | | | 46.5 |
| RS IN | ( + ) | 646.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Tugela - Sterkfontein | 529.6 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | | | | | |
| ANSFERS | ( +\- ) | | | | | |
| ATION | ( - ) | 409.3 | 0.0 | | | |
| S OUT | ( - ) | 3523.7 | 0 | 0 | 0 | 0 |
| | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 633.1 | | | | |
| | - Flood release | 2555.4 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| CHANGE | ( + ) | 913.4 | 0 | 0 | 0 | 0 |
| CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 913.4 | | | | |
| as at 30 September 1997] | | 5342.8 | 0.0 | 0.0 | 0.0 | 296.7 |

## t account for water resources in the Upper Vaal Water Management Area for 1998 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNDW |
| | | A | B + C | B | C | D |
| K [ AS AT 1st OCTOBER 1997 ] | | 5342.82 | 0 | | | 296.7 |
| | Sustainable use ( - ) | 1781.7 | 0 | | | 46.4 |
| | : of which Crocodile WMA transfer | 698.1 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 610.3 | 0 | 0.0 | 0.0 | 0.0 |
| / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 341.9 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 2871.6 | 0 | | | 46.4 |
| ERS IN | ( + ) | 798.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Tugela - Sterkfontein | 411.2 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | 270.0 | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION | ( - ) | 409.3 | 0.0 | | | |
| ERS OUT | ( - ) | 2401.4 | 0 | 0 | 0 | 0 |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile (included in abstraction ) | | | | | |
| | - Middle Vaal | 798.8 | | | | |
| | - Flood release | 1267.4 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 636.7 | 0 | 0 | 0 | 0 |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 636.7 | | | | |
| K [as at 30 September 1998] | | 4968.9 | 0.0 | 0.0 | 0.0 | 296.7 |

## t account for water resources in the Upper Vaal Water Management Area for 1999 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNDW |
| | | A | B + C | B | C | D |
| K [ AS AT 1st OCTOBER 1998 ] | ( + ) | 4968.87 | 0 | | | 296.7 |
| | Sustainable use ( - ) | 1845.2 | 0 | | | 46.4 |
| | : of which Crocodile WMA transfer | 723.5 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 619.8 | 0 | 0.0 | 0.0 | 0.0 |
| S / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 351.4 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 2447.5 | 0 | | | 46.4 |
| TERS IN | ( + ) | 750.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Tugela - Sterkfontein | 33.5 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | 600.0 | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION | ( - ) | 409.4 | 0.0 | | | |
| ERS OUT | ( - ) | 1300.4 | 0 | 0 | 0 | 0 |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 881.7 | | | | |
| | - Flood release | 83.4 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 347.8 | 0 | 0 | 0 | 0 |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 347.8 | | | | |
| K [as at 30 September 1999] | | 4855.9 | 0.0 | 0.0 | 0.0 | 296.7 |

## t account for water resources in the Upper Vaal Water Management Area for 2000 (millions of cubic metres)

| | | SURFACE WATER | | | | |
|---|---|---|---|---|---|---|
| | | DAMS AND OTHER INTERMEDIATE STORAGE CAPACITY | TOTAL RIVER | PERENNIAL RIVER | EPHEMERAL RIVER | GROUNDWA |
| | | A | B + C | B | C | D |
| K [ AS AT 1st OCTOBER 1999 ] | ( + ) | 4855.91 | 0 | | | 296.7 |
| | Sustainable use ( - ) | 1911.5 | 0 | | | 46.3 |
| | : of which Crocodile WMA transfer | 749.7 | | | | |
| | Depletion of groundwater stocks | | | | | |
| FLOWS | ( + ) | 629.6 | 0 | 0.0 | 0.0 | 0.0 |
| / RESIDUALS | Irrigation water | 11.4 | 0 | | | |
| | Cooling water | 0.0 | 0 | | | |
| | Wastewater treated | 361.1 | 0 | | | |
| | Wastewater untreated | 257.1 | 0 | | | |
| | Other returns | 0.0 | 0 | | | |
| ( ANNUAL RUN OFF ) | ( + ) | 5865.5 | 0 | | | 46.3 |
| ERS IN | ( + ) | 835.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Tugela - Sterkfontein | 118.2 | | | | |
| | - Usuthu | 116.8 | | | | |
| | - Lesotho Highlands | 600.0 | | | | |
| TRANSFERS | ( +\- ) | | | | | |
| RATION | ( - ) | 409.4 | 0.0 | | | |
| ERS OUT | ( - ) | 3951.4 | 0 | 0 | 0 | 0 |
| T | - Olifants | 35.7 | | | | |
| | - Crocodile ( included in abstraction ) | | | | | |
| | - Middle Vaal | 766.0 | | | | |
| | - Flood release | 2850.2 | | | | |
| | - Ecological Reserve | 299.5 | | | | |
| E CHANGE | ( + ) | 408 | 0 | 0 | 0 | 0 |
| E CHANGES | Due to natural disaster | | | | | |
| | Discovery | | | | | |
| | Others | 408 | | | | |
| K [as at 30 September 2000] | | 5572.1 | 0.0 | 0.0 | 0.0 | 296.7 |

The storage capacity in the Upper Vaal WMA consists of the following dams:

| Name | Full capacity (Millions of cubic metres) |
|---|---|
| Vaal | 2603,4 |
| Grootdraai | 354,7 |
| Sterkfontein | 2616,9 |
| Barrage | 47,0 |
| Smalldams | 183,5 |
| Total capacity | 5805,5 |

Outside the WMA, the following dams act as storage dams for various water augmentation schemes that supplement supply in the Upper Vaal WMA:

Lesotho Highlands Water Scheme

| Name | Full capacity (Millions of cubic metres) |
|---|---|
| Katse | 1950 |
| Mohale | 938 |
| Total | 2888 |

Tugela

| Name | Full capacity (Millions of cubic metres) |
|---|---|
| Woodstock | 380,8 |
| Killburn | 35,7 |
| Driel Barrage | 10,3 |
| Zaaihoek | 193,0 |
| Total | 619,8 |

It was decided to use only the volumes of the dams in the Upper Vaal WMA itself for the asset account because of the following:

- Dam levels are available on a daily basis.
- Water from dams outside the Upper Vaal WMA is not only used in the WMA.
- Water from the Katse and Mohale dams is also used to supplement water in the Orange River if necessary.

Table 43 represents the Dam levels in the Upper Vaal WMA from 1990 to 2000.

**Table 43 - Dam levels (Hydrology year is from 1 October to 30 September)**

| | Date | Vaaldam | Grootdraai | Sterkfontein | Barrage | Smalldams | Total stock | Percentage of full capacity |
|---|---|---|---|---|---|---|---|---|
| Opening stock | 1/10/90 | 2145.89 | 300.64 | 2173.48 | 47 | 152.33 | 4819.3 | 83.01 % |
| Closing stock | 30/9/91 | 1748.47 | 280.39 | 2444.09 | 47 | 147.54 | 4667.4 | 80.40 % |
| Opening stock | 1/10/91 | 1748.47 | 280.39 | 2444.09 | 47 | 147.54 | 4667.4 | 80.40 % |
| Closing stock | 30/9/92 | 440.18 | 178.82 | 2566.69 | 47 | 105.53 | 3338.2 | 57.50 % |
| Opening stock | 1/10/92 | 440.18 | 178.82 | 2566.69 | 47 | 105.53 | 3338.2 | 57.50 % |
| Closing stock | 30/9/93 | 458.41 | 201.78 | 1701.21 | 47 | 78.63 | 2487.0 | 42.84 % |
| Opening stock | 1/10/93 | 458.41 | 201.78 | 1701.21 | 47 | 78.63 | 2487.0 | 42.84 % |
| Closing stock | 30/9/94 | 824.54 | 323.14 | 2111.87 | 47 | 107.94 | 3414.4 | 58.81 % |
| Opening stock | 1/10/94 | 824.54 | 323.14 | 2111.87 | 47 | 107.94 | 3414.4 | 58.81 % |
| Closing stock | 30/9/95 | 365.09 | 321.24 | 1403.63 | 47 | 69.77 | 2206.7 | 38.01 % |
| Opening stock | 1/10/95 | 365.09 | 321.24 | 1403.63 | 47 | 69.77 | 2206.7 | 38.01 % |
| Closing stock | 30/9/96 | 2405.04 | 319.99 | 1585.71 | 47 | 142.24 | 4499.9 | 77.51 % |
| Opening stock | 1/10/96 | 2405.04 | 319.99 | 1585.71 | 47 | 142.24 | 4499.9 | 77.51 % |
| Closing stock | 30/9/97 | 2738.6 | 354.9 | 2033.44 | 47 | 168.88 | 5342.8 | 92.03 % |
| Opening stock | 1/10/97 | 2738.6 | 354.9 | 2033.44 | 47 | 168.88 | 5342.8 | 92.03 % |
| Closing stock | 30/9/98 | 2105.57 | 295.74 | 2363.5 | 47 | 157.06 | 4968.8 | 85.59 % |
| Opening stock | 1/10/98 | 2105.57 | 295.74 | 2363.5 | 47 | 157.06 | 4968.8 | 85.59 % |
| Closing stock | 30/9/99 | 2064 | 275.71 | 2315.71 | 47 | 153.09 | 4855.9 | 83.64 % |
| Opening stock | 1/10/99 | 2064 | 275.71 | 2315.71 | 47 | 153.49 | 4855.9 | 83.64 % |
| Closing stock | 30/9/00 | 2668.41 | 329.63 | 2350.93 | 47 | 176.12 | 5572.0 | 95.98 % |

**Source: Statistics South Africa**

The following table 44 on page 50 represents the annual runoff, mean annual runoff, transfers in and return flows to provide annual supply without taking into consideration dams' stocks over the relevant 10 year period.

**Table 44 - Water supply 1991-2000 (millions cubic metres)**

| *Year* | *Annual runoff* | *Mean annul runoff* | *Transfers in* | *Return flow* | *Annual supply* |
|---|---|---|---|---|---|
| 1991 | 1580.5 | 2422.7 | 463.5 | 549.8 | 2593.8 |
| 1992 | 565.7 | 2422.7 | 427.7 | 557.8 | 1551.2 |
| 1993 | 1046.5 | 2422.7 | 633.9 | 566.1 | 2246.5 |
| 1994 | 2571.8 | 2422.7 | 629 | 574.6 | 3775.4 |
| 1995 | 966 | 2422.7 | 625 | 583.3 | 4597 |
| 1996 | 9558.9 | 2422.7 | 641.6 | 592.1 | 10792.6 |
| 1997 | 5261.2 | 2422.7 | 641.4 | 601.1 | 6503.7 |
| 1998 | 3124.6 | 2422.7 | 793 | 610.3 | 4527.9 |
| 1999 | 2701.4 | 2422.7 | 745.3 | 619.8 | 4066.5 |
| 2000 | 6119.9 | 2422.7 | 830 | 629.6 | 7579.2 |

**Source: Statistics South Africa**

The following should be noted about data in table 44.

- Annual Runoff: Water Research Commission Report: No. 298/1/94 – Surface Water Resources of South Africa 1990, provides runoff data for the period 1920-1989. There is at present an ongoing project to update the official data to 2000. The data used here were calculated using direct and indirect data received from DWAF – Hydrology Unit. The updated official data is expected to be available in 2003.
- Mean Annual Runoff: The 70 year Mean Annual Runoff for the Upper Vaal WMA is 2422,7 x $10^6 m^3$ while the average for this 10 year period is 3349,6 x $10^6 m^3$, which means the rainfall was higher than average. In the first 5 years of the study period the runoff was below average with the last five years being very wet.

# 4. Monetary water accounts

This section utilizes the physical water accounts previously discussed to derive a set of monetary accounts relating to water. The economic benefits that arise from the usage of water from the Upper Vaal WMA, as well as the delivery costs, tariffs and consequent subsidies/overrecoveries pertaining to this usage, will be discussed.

The main intention in this section is to supply as much data as possible concerning the following:

- Contribution to value added of water used per sector in the Upper Vaal WMA (1991-2000).
- Contribution to employment of water used per sector in the Upper Vaal WMA (1991-2000).
- Delivery costs of water used per sector in the Upper Vaal WMA (1991-2000).
- Revenue from water tariffs per sector in the Upper Vaal WMA (1991-2000).
- Subsidies and overrecoveries of water used per sector in the Upper Vaal WMA (2000).

Cognisance should be taken of the fact that reliable delivery costs and tariffs are only available for the year 2000. The true nature and magnitude of subsidies/overrecoveries for the Upper Vaal WMA were only determined for a single year. For the other years no reliable tariffs and delivery costs are available hence subsidies/overrecoveries were not calculated to avoid a misrepresentation of the water pricing policy.

## 4.1 Economic benefits

The construction of water resource accounts in physical units for the Upper Vaal WMA lends itself to determining the economic benefits arising from the water usage in this particular WMA. These benefits are measured in terms of –

- Value added
- Employment

In a water-scarce country, the provision of water must always be considered in terms of the socio-economic benefits that a specific water user contributes. Value added indicates the magnitude of economic activities that result from water use and is also an important indicator of incomes generated. On the other hand, employment opportunities provide an indicator of the level of participation in the economy.

### 4.1.1 Value added

The contribution of each use sector to value added, on an annual basis from 1991 to 2000, is provided in table 45 on page 52 to table 54 on page 61.

Value added is one approach to derive Gross Domestic Product. It is a method which entails summing the values added at each stage of the production process and successive values added to the original raw material in different stages of production.

## ution to value added of water used per sector in the Upper Vaal Water Management Area for 1991 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIREMENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5629.3 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5629.3 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5629.3 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 63505.8 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| )P ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5629.3 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 63505.8 | 0.0 | |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1992 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5736.8 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5736.8 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5736.8 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 66320.6 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5736.8 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 66320.6 | 0.0 | 0.0 |

## ibution to value added of water used per sector in the Upper Vaal Water Management area for 1993 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5846.4 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5846.4 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5846.4 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 69260.1 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5846.4 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 69260.1 | 0.0 | |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1994 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5958.1 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5958.1 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 5958.1 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 72329.9 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 5958.1 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 72329.9 | 0.0 | |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1995 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6071.9 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6071.9 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6071.9 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75535.8 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6071.9 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 75535.8 | 0.0 | 0.0 |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1996 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6185.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6185.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6185.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78741.7 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6185.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 78741.7 | 0.0 | |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1997 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6301.6 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6301.6 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6301.6 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 82083.6 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6301.6 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 82083.6 | 0.0 | 0.0 |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 1998 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6419.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6419.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6419.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 85567.4 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6419.7 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 85567.4 | 0.0 | |

## ribution to value added of water used per sector in the Upper Vaal Water Management Area for 1999 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6540.0 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6540.0 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6540.0 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89199.1 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| ( GDP ) | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6540.0 | 13604.9 | 0.0 | 0.0 | 0.0 | 0.0 | 89199.1 | 0.0 | |

## ibution to value added of water used per sector in the Upper Vaal Water Management Area for 2000 (R millions)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L |
| | 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6662.6 | 13604.9 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | PERENNIAL SURFACE WATER | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6662.6 | 13604.9 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2 | - Water abstracted for own use | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 6662.6 | 13604.9 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2.1 | - of which for irrigation | 49.7 | 49.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | GROUNDWATER | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 4 | - Water abstracted for own use | 357.4 | 0.0 | 357.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 92984.8 | 0.0 |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | | |
| | | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| GDP ) | | | 407.0 | 49.7 | 357.4 | 0.0 | 0.0 | 6662.6 | 13604.9 | 0.0 | | 0.0 | | 0.0 | 0.0 | 92984.8 | 0.0 |
| | | | | | | | | | | | | | | | | | |

From table 45 to table 54, it is apparent that only certain water use sectors make a contribution towards value added. These are –

- Irrigation agriculture
- Livestock
- Energy
- Mining and heavy industries
- Urban requirements

The other water use sectors are not considered direct contributors to value added either due to the fact that they did not use water in the first instance or because including them in value added would imply double-counting in the system, for an example households and the environment.

Table 55 summarizes the contribution to value added per water use sector on an annual basis.

**Table 55 - Annual contribution to value added of water used per sector in the Upper Vaal WMA (1991 – 2000) (R millions, 2000 prices)**

| | *Irrigation agriculture* | *Livestock* | *Energy* | *Mining & heavy industries* | *Urban requirements* | *Total (annual)* |
|---|---|---|---|---|---|---|
| 1991 | 50 | 357 | 5,629 | 13,605 | 63,506 | 83,147 |
| 1992 | 50 | 357 | 5,737 | 13,605 | 66,321 | 86,069 |
| 1993 | 50 | 357 | 5,846 | 13,605 | 69,260 | 89,118 |
| 1994 | 50 | 357 | 5,958 | 13,605 | 72,330 | 92,300 |
| 1995 | 50 | 357 | 6,072 | 13,605 | 75,536 | 95,620 |
| 1996 | 50 | 357 | 6,186 | 13,605 | 78,742 | 98,939 |
| 1997 | 50 | 357 | 6,302 | 13,605 | 82,084 | 102,397 |
| 1998 | 50 | 357 | 6,420 | 13,605 | 85,567 | 105,999 |
| 1999 | 50 | 357 | 6,540 | 13,605 | 89,199 | 109,751 |
| 2000 | 50 | 357 | 6,663 | 13,605 | 92,985 | 113,659 |

**Source: Statistics South Africa**

According to table 55, the contribution to value added of water used per sector in the Upper Vaal WMA increased by approximately 37 % from R83,1 billion in 1991 to R113,7 billion in 2000 (in constant 2000 prices). The water use sectors that contribute most towards value added are urban requirements, mining and heavy industries and energy.

It is clear that the contribution to value added is predominantly a result of water usage due to urban requirements. Urban requirements represent water used in urban areas such as light industries and parks but exclude domestic requirements. According to table 55 this holds true for each of the relevant years. Mining and heavy industries also contribute a small portion of 12 % of total value added.

Another important feature of table 55 is the constant contributions towards value added made by certain water use sectors. The constant values for irrigation agriculture are due to restrictions imposed through DWAF not allowing expansions in the hectares under irrigation along the Upper Vaal WMA. As far as the contribution towards value added of livestock is concerned, the argument is that this sector has reached its peak and no expansion is expected. It should also be noted that table 55 reflects sectoral contributions to value added in constant prices.

### 4.1.2 Employment

The contribution of each use sector to employment is provided in table 56 on page 64 to table 65 on page 73 on an annual basis from 1991 to 2000.

## bution to employment of water used per sector in the Upper Vaal Water Management Area for 1991 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18059.9 | 62919.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18059.9 | 62919.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18059.9 | 62919.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 749667.8 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18059.9 | 62919.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 749667.8 | 0.0 | 0.0 |

## ibution to employment of water used per sector in the Upper Vaal Water Management Area for 1992 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18404.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18404.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18404.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 782895.4 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18404.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 782895.4 | 0.0 | 0.0 |

## ution to employment of water used per sector in the Upper Vaal Water Management Area for 1993 (number of employees)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18756.3 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18756.3 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 18756.3 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 817595.7 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| | ORTUNITIES | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 18756.3 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 817595.7 | 0.0 | |

## ibution to employment of water used per sector in the Upper Vaal Water Management Area for 1994 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19114.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19114.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19114.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 853833.9 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19114.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 853833.9 | 0.0 | |

## ibution to employment of water used per sector in the Upper Vaal Water Management Area for 1995 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIREMENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19479.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19479.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19479.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 891678.4 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19479.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 891678.4 | 0.0 | |

# ution to employment of water used per sector in the Upper Vaal Water Management Area for 1996 (number of employees)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19844.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19844.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 19844.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 929522.9 | 0.0 | 0.0 |
| 1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| | - Irrigation water | | | | | | | | | | | | | | |
| | - Cooling water | | | | | | | | | | | | | | |
| | - Wastewater treated | | | | | | | | | | | | | | |
| ) | - Wastewater untreated | | | | | | | | | | | | | | |
| | - Losses/leakages | | | | | | | | | | | | | | |
| 2 | - Other returns | | | | | | | | | | | | | | |
| | ORTUNITIES | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 19844.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 929522.9 | 0.0 | 0.0 |

## ibution to employment of water used per sector in the Upper Vaal Water Management Area for 1997 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20216.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20216.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20216.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 968973.6 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20216.7 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 968973.6 | 0.0 | |

## ribution to employment of water used per sector in the Upper Vaal Water Management Area for 1998 (number of employe

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | REST OF THE WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20595.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20595.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20595.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1010098.6 | 0.0 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| OPPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20595.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1010098.6 | 0.0 | 0.0 |

## ibution to employment of water used per sector in the Upper Vaal Water Management Area for 1999 (number of employees

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20981.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20981.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 20981.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1052969.1 | 0.0 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| PPORTUNITIES | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 20981.6 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1052969.1 | 0.0 | |

**ıtribution to employment of water used per sector in the Upper Vaal Water Management Area for 2000 (number nployees)**

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | REST OF TH WOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | M |
| | 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | |
| | | TOTAL WATER ABSTRACTED | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 21374.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | PERENNIAL SURFACE WATER | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 21374.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2 | - Water abstracted for own use | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 21374.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2.1 | - of which for irrigation | 2902.3 | 2902.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | GROUNDWATER | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 4 | - Water abstracted for own use | 28468.1 | 0.0 | 28468.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | |
| | 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1097659.0 | 0.0 | 0.0 |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 1 | 12 | - Other returns | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| OPPORTUNITIES | | | 31370.5 | 2902.3 | 28468.1 | 0.0 | 0.0 | 21374.8 | 62919.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1097659.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | |

As in the case of value added, only some water use sectors make a contribution towards employment. These are –

- Irrigation agriculture
- Livestock
- Energy
- Mining and heavy industries
- Urban requirements

The primary reason for not including all the water use sectors in the determination of the contribution towards employment is the risk of double-counting which exists.

**Table 66 - The annual contribution to employment of water used per sector in the Upper Vaal River WMA (1991 – 2000)**

| Year | Irrigation Agriculture | Livestock | Energy | Mining & heavy industries | Urban requirements | Total (annual) |
|---|---|---|---|---|---|---|
| 1991 | 2 902 | 28 468 | 18 060 | 62 920 | 74 9668 | 862 018 |
| 1992 | 2 902 | 28 468 | 18 405 | 62 920 | 782 895 | 895 590 |
| 1993 | 2 902 | 28 468 | 18 756 | 62 920 | 817 596 | 930 642 |
| 1994 | 2 902 | 28 468 | 19 115 | 62 920 | 853 834 | 967 239 |
| 1995 | 2 902 | 28 468 | 19 480 | 62 920 | 891 678 | 1 005 448 |
| 1996 | 2 902 | 28 468 | 19 845 | 62 920 | 929 523 | 1 043 658 |
| 1997 | 2 902 | 28 468 | 20 217 | 62 920 | 968 974 | 1 083 480 |
| 1998 | 2 902 | 28 468 | 20 596 | 62 920 | 1 010 099 | 1 124 984 |
| 1999 | 2 902 | 28 468 | 20 982 | 62 920 | 1 052 969 | 1 168 241 |
| 2000 | 2 902 | 28 468 | 21 375 | 62 920 | 1 097 659 | 1 213 324 |

**Source: Statistics South Africa**

According to table 66 the contribution of water used to employment was 1 213 324 employees in the year 2000. This is almost 41 % higher than the estimate for 1991. The water use sector that contributes mostly to employment, is urban requirements. However, mining and heavy industries also contribute significantly towards employment. This is demonstrated in table 67 for 1991 and 2000. Employment in the irrigation agriculture and livestock sectors is constant throughout the period reflecting data limitations. Mining and heavy industries shows a slight decrease in growth.

**Table 67 - Percentage contribution to employment of water used per sector in the Upper Vaal WMA (1991 & 2000)**

| Sector | 1991 | 2000 |
|---|---|---|
| **Irrigation agriculture** | 0.3 | 0.2 |
| **Livestock** | 3.3 | 2.3 |
| **Energy** | 2.1 | 1.8 |
| **Mining & heavy industries** | 7.3 | 5.2 |
| **Urban requirements** | 87.0 | 90.5 |
| **Total** | 100% | 100% |

**Source: Statistics South Africa**

Interesting to note is that the contribution of urban requirements towards employment has increased from 87,0 % in 1991 to 90,5 % in 2000. This is an indication of the large-scale urbanisation which characterized the Upper Vaal River WMA over the last few decades.

## 4.2 Delivery Costs, Tariffs and Subsidies

In this section, the cost of water delivery to the various use sectors, the tariffs they pay and the subsidization of their water delivery costs are analysed. The new water price policy for South Africa forms the basis of the water delivery costs and tariffs that are used in this study. However, it is important to note that historic water cost and tariff data are not available. Tariffs and costs are only available for 1998. The 1998 tariffs and costs were applied for the remaining years. In other words, other years are analysed as if the new water policy was in place during that time and the 1998 costs and tariffs were in effect. The result is that the analyses over time does not reflect relative tariff and cost changes per physical unit of water. The cross subsidisation is calculated by subtracting the tariff revenue per sector from the cost of providing water to the relevant sector.

### 4.2.1 Delivery costs

The delivery costs of water used per sector in the Upper Vaal WMA from 1991 to 2000 are provided in table 68 on page 76 to table 77 on page 85.

## ry cost of water used per sector in the Upper Vaal Water Management Area for 1991 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 38.8 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 38.8 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 38.8 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 181.5 | 110.7 | 2.1 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 38.8 | 99.7 | 0.0 | 0.0 | 0.0 | 181.5 | 110.7 | 2.1 | |

## cost of water used per sector in the Upper Vaal Water Management Area for 1992 (R millions)

| | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 39.5 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 39.5 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 39.5 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 1 - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 1 - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 184.6 | 115.6 | 2.1 | |
| 1 - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| - Irrigation water | | | | | | | | | | | | | | |
| - Cooling water | | | | | | | | | | | | | | |
| - Wastewater treated | | | | | | | | | | | | | | |
| ) - Wastewater untreated | | | | | | | | | | | | | | |
| 1 - Losses/leakages | | | | | | | | | | | | | | |
| 2 - Other returns | | | | | | | | | | | | | | |
| | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 39.5 | 99.7 | 0.0 | 0.0 | 0.0 | 184.6 | 115.6 | 2.1 | |

## ry cost of water used per sector in the Upper Vaal Water Management Area for 1993 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURA REQU E-MENT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 40.3 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 40.3 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 40.3 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 187.7 | 120.7 | 2.1 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.( |
| | WATER RETURNED (WATER DISCHARGED ) | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 40.3 | 99.7 | 0.0 | 0.0 | 0.0 | 187.7 | 120.7 | 2. |

## cost of water used per sector in the Upper Vaal Water Management Area for 1994 (R millions)

| | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.1 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.1 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.1 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 190.9 | 126.0 | 2.1 | |
| - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| - Irrigation water | | | | | | | | | | | | | | |
| - Cooling water | | | | | | | | | | | | | | |
| - Wastewater treated | | | | | | | | | | | | | | |
| - Wastewater untreated | | | | | | | | | | | | | | |
| - Losses/leakages | | | | | | | | | | | | | | |
| - Other returns | | | | | | | | | | | | | | |
| | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 41.1 | 99.7 | 0.0 | 0.0 | 0.0 | 190.9 | 126.0 | 2.1 | |

## cost of water used per sector in the Upper Vaal Water Management Area for 1995 (R millions)

| | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L |
| RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.9 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.9 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 41.9 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1 - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 194.2 | 131.6 | 2.1 |
| 1 - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | |
| - Irrigation water | | | | | | | | | | | | | |
| - Cooling water | | | | | | | | | | | | | |
| - Wastewater treated | | | | | | | | | | | | | |
| ) - Wastewater untreated | | | | | | | | | | | | | |
| 1 - Losses/leakages | | | | | | | | | | | | | |
| 2 - Other returns | | | | | | | | | | | | | |
| | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 41.9 | 99.7 | 0.0 | 0.0 | 0.0 | 194.2 | 131.6 | 2.1 |

## y cost of water used per sector in the Upper Vaal Water Management Area for 1996 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIRE-MENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 42.6 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 42.6 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 42.6 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 197.5 | 137.2 | 2.1 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 42.6 | 99.7 | 0.0 | 0.0 | 0.0 | 197.5 | 137.2 | 2.1 |

## ry cost of water used per sector in the Upper Vaal Water Management Area for 1997 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 43.4 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 43.4 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 43.4 | 99.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 200.8 | 143.0 | 2.1 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 43.4 | 99.7 | 0.0 | 0.0 | 0.0 | 200.8 | 143.0 | 2.1 | |

## cost of water used per sector in the Upper Vaal Water Management Area for 1998 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 44.3 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 44.3 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 44.3 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 204.2 | 149.1 | 2.1 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 44.3 | 99.7 | 0.0 | | 0.0 | | 0.0 | 204.2 | 149.1 | 2.1 | |

## ery cost of water used per sector in the Upper Vaal Water Management Area for 1999 (R millions)

| | | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| | 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.1 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.1 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.1 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 207.6 | 155.4 | 2.1 | |
| | 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | | | |
| | 7 | - Irrigation water | | | | | | | | | | | | | | | | |
| | 8 | - Cooling water | | | | | | | | | | | | | | | | |
| | 9 | - Wastewater treated | | | | | | | | | | | | | | | | |
| | 10 | - Wastewater untreated | | | | | | | | | | | | | | | | |
| | 11 | - Losses/leakages | | | | | | | | | | | | | | | | |
| | 12 | - Other returns | | | | | | | | | | | | | | | | |
| ST | | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 45.1 | 99.7 | 0.0 | | 0.0 | | 0.0 | 207.6 | 155.4 | 2.1 | |

## y cost of water used per sector in the Upper Vaal Water Management Area for 2000 (R )

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | REST OF THE WORLD | ENVIRONMENT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | | H | | I | J | K | L | M | N |
| 1 | RAIN | 17.4 | 0.0 | 0.0 | 17.4 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.9 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.9 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 45.9 | 99.7 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 65.4 | 65.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | | | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 211.1 | 162.0 | 2.1 | 431.1 | 0.0 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | | | | | | | | | | | | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | | | | 0.0 |
| 7 | - Irrigation water | | | | | | | | | | | | | | | | | 0.0 |
| 8 | - Cooling water | | | | | | | | | | | | | | | | | 0.0 |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | | | 0.0 |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | | | 0.0 |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | | | 0.0 |
| 12 | - Other returns | | | | | | | | | | | | | | | | | 0.0 |
| | | | | | | | | | | | | | | | | | | |
| | | 82.9 | 65.4 | 0.0 | 17.4 | 0.0 | 45.9 | 99.7 | 0.0 | | 0.0 | | 0.0 | 211.1 | 162.0 | 2.1 | 431.1 | 0.0 |

**Table 78 - Annual delivery costs of water per sector in the Upper Vaal River WMA (1991 – 2000) - R million in 2000 prices**

| Year | Irrigation agriculture | Afforestation & alien plants | Energy | Mining & heavy industries | Household | Urban requirement | Rural requirement | Rest of the World | Total (annual) |
|---|---|---|---|---|---|---|---|---|---|
| **1991** | 65 | 17 | 39 | 100 | 181 | 111 | 2 | 245 | 761 |
| **1992** | 65 | 17 | 40 | 100 | 185 | 116 | 2 | 262 | 786 |
| **1993** | 65 | 17 | 40 | 100 | 188 | 121 | 2 | 279 | 813 |
| **1994** | 65 | 17 | 41 | 100 | 191 | 126 | 2 | 298 | 841 |
| **1995** | 65 | 17 | 42 | 100 | 194 | 132 | 2 | 318 | 870 |
| **1996** | 65 | 17 | 43 | 100 | 197 | 137 | 2 | 338 | 900 |
| **1997** | 65 | 17 | 43 | 100 | 201 | 143 | 2 | 359 | 931 |
| **1998** | 65 | 17 | 44 | 100 | 204 | 149 | 2 | 382 | 964 |
| **1999** | 65 | 17 | 45 | 100 | 208 | 155 | 2 | 406 | 998 |
| **2000** | 65 | 17 | 46 | 100 | 211 | 162 | 2 | 431 | 1 035 |

**Source: Statistics South Africa**

According to table 78, the cost of supplying raw water amounted to approximately R1 billion in 2000. The water use sectors with the highest delivery costs are:

- Rest of the world (all other WMAs except Upper Vaal WMA)
- Households and
- Urban requirements

Due to a constant supply of water to most sectors as well as a fixed cost to supply water used due to data limitations, most sectors exhibit a constant trend of supply costs from 1999-2001.

### 4.2.2 Tariffs

The revenues derived from water tariffs for different water use sectors are provided from 1991 to 2000 in table 79 on page 87 to table 88 on page 96.

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1991 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 64.0 | 164.4 | 0.0 | 0.0 | 0.0 | 6.1 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 64.0 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 64.0 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.1 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.1 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 299.3 | 182.5 | 3.5 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 64.0 | 164.4 | 0.0 | 0.0 | 0.0 | 305.4 | 182.5 | 3.5 |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1992 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIREMENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 65.2 | 164.4 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 65.2 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 65.2 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.0 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 304.5 | 190.6 | 3.5 | 4 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 65.2 | 164.4 | 0.0 | 0.0 | 0.0 | 310.5 | 190.6 | 3.5 | 4 |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1993 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 66.5 | 164.4 | 0.0 | | 0.0 | | 0.0 | 5.9 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 66.5 | 164.4 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 66.5 | 164.4 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.9 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.9 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 309.7 | 199.1 | 3.5 | 4 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 66.5 | 164.4 | 0.0 | | 0.0 | | 0.0 | 315.6 | 199.1 | 3.5 | 4 |

## e from water tariffs per sector in the Upper Vaal Water Management Area for 1994 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 67.8 | 164.4 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 67.8 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 67.8 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 315.0 | 207.9 | 3.5 | 4 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 67.8 | 164.4 | 0.0 | 0.0 | 0.0 | 320.8 | 207.9 | 3.5 | 4 |

## e from water tariffs per sector in the Upper Vaal Water Management Area for 1995 (R millions )

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I ( W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 69.0 | 164.4 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 69.0 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 69.0 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 320.4 | 217.1 | 3.5 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED (WATER DISCHARGED) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 69.0 | 164.4 | 0.0 | 0.0 | 0.0 | 326.1 | 217.1 | 3.5 | |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1996 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 70.3 | 164.4 | 0.0 | 0.0 | 0.0 | 5.7 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 70.3 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 70.3 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.7 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.7 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 325.7 | 226.3 | 3.5 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 70.3 | 164.4 | 0.0 | 0.0 | 0.0 | 331.4 | 226.3 | 3.5 | |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1997 ( R millions )

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 71.7 | 164.4 | 0.0 | 0.0 | 0.0 | 5.6 | 0.0 | 0.0 |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 71.7 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 71.7 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.6 | 0.0 | 0.0 |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.6 | 0.0 | 0.0 |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 331.2 | 235.9 | 3.5 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 71.7 | 164.4 | 0.0 | 0.0 | 0.0 | 336.8 | 235.9 | 3.5 |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1998 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF | IRRIGATION WATER | COLLECTION AND | DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | | H | | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 73.0 | 164.4 | 0.0 | | 0.0 | | 0.0 | 5.5 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 73.0 | 164.4 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 73.0 | 164.4 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.5 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 5.5 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 336.8 | 246.0 | 3.5 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | | | |
| 7 | - Irrigat ion water | | | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | | | |
| 11 | - Losses/leakages | | | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 73.0 | 164.4 | 0.0 | | 0.0 | | 0.0 | 342.3 | 246.0 | 3.5 | |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 1999 ( R millions )

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORE-STATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIRE-MENTS | RURAL REQUIRE-MENTS | RE OF WC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B +C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 74.4 | 164.4 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 74.4 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 74.4 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 342.5 | 256.4 | 3.5 | 6 |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | | | | | | | | | | | | | | |
| 7 | - Irrigation water | | | | | | | | | | | | | | |
| 8 | - Cooling water | | | | | | | | | | | | | | |
| 9 | - Wastewater treated | | | | | | | | | | | | | | |
| 10 | - Wastewater untreated | | | | | | | | | | | | | | |
| 11 | - Losses/leaLages | | | | | | | | | | | | | | |
| 12 | - Other returns | | | | | | | | | | | | | | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 74.4 | 164.4 | 0.0 | 0.0 | 0.0 | 347.9 | 256.4 | 3.5 | 6 |

## ue from water tariffs per sector in the Upper Vaal Water Management Area for 2000 (R millions)

| | | TOTAL AGRICULTURE | IRRIGATION AGRICULTURE | LIVESTOCK | AFFORESTATION & ALIEN PLANTS | FISHERIES | ENERGY | MINING AND HEAVY INDUSTRIES | DISTRIBUTION OF IRRIGATION WATER | COLLECTION AND DISTRIBUTION OF WATER | SEWERAGE | HOUSEHOLDS | URBAN REQUIREMENTS | RURAL REQUIREMENTS | I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A+B+C | A | B | C | D | E | F | G | H | I | J | K | L | |
| 1 | RAIN | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | TOTAL WATER ABSTRACTED | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 75.8 | 164.4 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| | PERENNIAL SURFACE WATER | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 75.8 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2 | - Water abstracted for own use | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 75.8 | 164.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 2.1 | - of which for irrigation | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 3 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | GROUNDWATER | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| 4 | - Water abstracted for own use | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | |
| 4.1 | - of which for irrigation | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 5 | - Water abstracted for delivery | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 6 | WATER DELIVERED THROUGH MAINS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 348.2 | 267.3 | 3.5 | |
| 6.1 | - of which : Wastewater | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | WATER RETURNED ( WATER DISCHARGED ) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 7 | - Irrigation water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 8 | - Cooling water | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 9 | - Wastewater treated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 10 | - Wastewater untreated | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 11 | - Losses/leakages | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| 12 | - Other returns | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| E | | 3.2 | 3.2 | 0.0 | 0.0 | 0.0 | 75.8 | 164.4 | 0.0 | 0.0 | 0.0 | 353.6 | 267.3 | 3.5 | |

**Table 89 – Annual revenue from water tariffs per sector in the Upper Vaal River WMA (1991-2000) – R million in 2000 prices**

| Year | Irrigation agriculture | Afforestation & alien plants | Energy | Mining & heavy industries | Houselods | Urban requirement | Rural requirement | Rest of the World | Total (annual) |
|---|---|---|---|---|---|---|---|---|---|
| 1991 | 3 | | 64 | 164 | 305 | 183 | 4 | 404 | 1 128 |
| 1992 | 3 | | 65 | 164 | 310 | 191 | 4 | 432 | 1 169 |
| 1993 | 3 | | 66 | 164 | 316 | 199 | 4 | 461 | 1 213 |
| 1994 | 3 | | 68 | 164 | 321 | 208 | 4 | 491 | 1 259 |
| 1995 | 3 | | 69 | 164 | 326 | 217 | 4 | 524 | 1 308 |
| 1996 | 3 | | 70 | 164 | 331 | 226 | 4 | 557 | 1 356 |
| 1997 | 3 | | 72 | 164 | 337 | 236 | 4 | 592 | 1 408 |
| 1998 | 3 | | 73 | 164 | 342 | 246 | 4 | 630 | 1 462 |
| 1999 | 3 | | 74 | 164 | 348 | 256 | 4 | 669 | 1 519 |
| 2000 | 3 | | 76 | 164 | 354 | 267 | 4 | 711 | 1 579 |

**Source: Statistics South Africa**

From table 89 it is apparent that the total revenue from water tariffs amounted to almost R1,6 billion in 2000, increasing by 40 % from R1,1 billion in 1991 (in constant 2000 prices). In 2000, 67 % of the total annual revenue is from the rest of the world (all other WMAs except the Upper Vaal WMA) and households. Irrigation agriculture, heavy industries and rural requirements remain constant because water usage in those sectors is static.

### 4.2.3 Subsidies and Over Recoveries

Table 90 presents an exposition of sectoral subsidization/overrecoveries with regard to the delivery costs of water to various sectors for the year 2000.

**Table 90 – Subsidies/ Over-recoveries of water used per sector in the Upper Vaal River WMA**

| Sector | Subsidies (+)/Overrecoveries (-) (2000, R million) |
|---|---|
| **Irrigation agriculture** | 62,2 |
| **Livestock** | 0 |
| **Afforestation & alien plants** | 17,4 |
| **Fisheries** | - |
| **Energy** | -29,8 |
| **Mining & heavy industries** | -64,7 |
| **Households** | -142,5 |
| **Urban requirements** | -105,3 |
| **Rural requirements** | -1,4 |
| **Rest of the world** | -280,0 |
| **Total** | -544,0 |

**Source: Statistics South Africa**

According to table 90 it is evident that irrigation agriculture and afforestation and alien plants are the only sectors in which subsidization takes place. On the contrary, the rest of the sectors are paying more than they should. The overall amount of overrecovery is R544 million and therefore results in a subsidization of some sectors.

# 5. Glossary

| | |
|---|---|
| **Account** | An account is a tool is which records, for a given aspects of economic life, (a) the uses and resources or (b) the changes in assets and the changes in liabilities and\or (c) the stock of assets and liabilities existing at a certain time; the transaction accounts include a balancing item which is used to equate the two sides of the accounts (e.g. resources and uses) and which is meaningful measure of economic performance in itself. |
| **Catchment** | A catchment is an area on which rain falls and the water thus run into a particular river. |
| **Compensation of employees** | Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period. Compensation of employees does not include any taxes payable by the employer on the wage and salary bill |
| **Evapotranspiration** | Evapotranspiration is the combined loss of water by evaporation from the soil or surface water and transpiration from the plants and animals. |
| **Groundwater** | Groundwater is freshwater beneath the earth's surface (usually in aquifers) supplying wells and springs. |
| **Human capital** | Human capital is productive wealth embodied in labour, skill and knowledge. |
| **Intermediate consumption** | Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods or services may be either transformed or used up by the production process. Some inputs re-emerge after having been transformed and incorporated into the outputs. Other inputs are completely consumed or used up. Intermediate consumption includes the rentals paid on the use of fixed assets. |
| **Mean annual runoff** | Mean annual runoff is the average annual flow under natural conditions. (This definition is dependent on the runoff regime for each river basin). |
| **Mineral exploration** | Mineral exploration consists of the value of expenditures on exploration for petroleum and natural gas and for non-petroleum deposits; it includes pre-license costs, license and acquisition costs, appraisal costs and the costs of actual test drilling and boring, as well as the costs aerial and other surveys, transportation costs, etc, incurred to make it possible to carry out the tests. |

| | |
|---|---|
| **Natural Resource Accounting** | Natural Resource Accounting is an accounting system that deals with stocks and stock changes of natural assets, comprising biota (produced or wild), subsoil assets (proved reserves), water and land with their aquatic and terrestrial ecosystems. It is frequently used in the sense of physical accounting as distinguished from monetary (environmental) accounting. |
| **Natural Resources** | Natural assets (raw materials) occurring in nature that can be used for economic production or consumption. |
| **Physical Accounting** | Natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units, for example, weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or ecosystem characteristics, may supplement quantitative measures. The combined changes in asset quality and quantity are called volume changes. |
| **Precipitation** | Precipitation is a) rain or snow falling from the atmosphere and deposited on land or water surfaces; (b) forced removal of particles from flue gases or waste water. |
| **Run-off** | Run-off is a portion of rainfall, melted snow or irrigation water that flows across the ground's surface and is eventually returned to streams. Run-off can pick up pollutants from air or land and carry them to receiving waters. |
| **Satellite accounts or systems** | Satellite accounts or systems is an additional or parallel accounting system that expands the analytical capacity of national accounts, without overburdening or disrupting the central system. It may provide additional information, apply complementary or alternative concepts, extend the coverage of costs and benefits of human activities and link physical with monetary data. |
| **Sustainability** | Sustainability is the concept refers to (a) use of the biosphere by present generation while maintaining its potential yield (benefit) for future generations; and/or (b) non-declining trends of economic growth and development that might be impaired by natural resource depletion and environmental degradation. |
| **System of integrated Environmental and Economic Accounting** | Satellite system of the System of National Accounts (SNA) proposed by the United Nations (1993a) for the incorporation of environment concerns (environmental costs, benefits and assets) into national accounts. |
| **System of National Accounts** | System of National Account revised (1993) system adopted worldwide for conventional economic (national) accounting (Commission of the European Communities and others, 1993). |
| **Water management area** | A water management are is an area defined for specific water management Purposes. |

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AR | Annual Runoff |
| CMA | Catchment Management Area |
| DWAF | Department of Water Affairs and Forestry |
| LSU | Large Stock Unit |
| MAR | Mean Annual Runoff |
| NRA | Natural Resource Accounting |
| RSA | Republic of South Africa |
| Stats SA | Statistics South Africa |
| SEEA | System of Environmental and Economic Accounting |
| UN | United Nations |
| WMA | Water Management Area |
| WRA | Water Resource Accounting |
| VA | Value Added |
| SNA | System of National Accounting |
| GDP | Gross National Product |
| SU-tables | Supply and Use tables |