# WHERE DOES OUR WATER COME FROM?

## THE CHALLENGE

People, like all living things, need water to survive and prosper. Sometimes people settle in areas where there is not a good source of water nearby. This is the case with the Witwatersrand area. At the end of the 19th century, many people came to the Witwatersrand in search of gold. As the mining town of Johannesburg grew, there wasn't enough water in the area to meet everybody's needs. Attempts by the Johannesburg Water Works Company to meet the demand were hampered by the Great Drought of 1895. Frequent complaints concerning water led to the appointment of the Water Works Commission in 1895 to examine ways in which Johannesburg could be provided with good quality drinking water.

A geologist by the name of Dr Draper, was commissioned by the Commission to assist. After searching on the farm Zuurbekom, Dr Draper found what everybody was looking for. He tied his handkerchief to the branch of a thorn bush and arriving back in Johannesburg, told the Water Works Commission "go to Zuurbekom, you will find my handkerchief tied to a tree, sink a borehole there and you will find water, plenty of it." In 1896 and 1897 the Water Works Commission secured a stable supply of water from the Zuurbekom Water Supply Companies wells. In 1903 the Water Works Commission established Rand Water in order to ensure that the Witwatersrand received enough clean, safe drinking water.

## GROUNDWATER

Initially Rand Water used groundwater from the Zuurbekom Wells on the West Rand. This water was of such good quality that it didn't require any cleaning (purification).

## NATURAL DRAINAGE

When the water from the Zuurbekom Wells could no longer supply enough water for the growing population of the Witwatersrand, the Vaal River to the south of Johannesburg was chosen as a new water source. In 1923 Rand Water dammed the Vaal River to form the Vaal River Barrage Reservoir. In 1938 the Vaal Dam was built upstream of the Vaal River Barrage Reservoir, which is now the main source of water for Rand Water. Rivers such as the Vaal and Wilge naturally flow into the Vaal Dam. These rivers flow through agricultural land and rural settlements with very little industry. This means that the water in the Vaal Dam is of a good quality by international standards.

## THE VAAL RIVER SYSTEM

The Vaal River system has its beginnings in the eastern highveld plains, in the vicinity of Ermelo. Shallow hollows and low hillocks form a natural sponge where water collects in pans, vleis and streams. These streams link up and the Vaal River is born, flowing westward on a long course, without rapids or waterfalls, broadening into a large river. To the Bushmen, the river was known as Gij'Gariep ("tawny") from its muddy colour. The European name, Vaal, also means tawny. The Sotho called it iliGwa ("erratic") because of the unpredictable variations in its flow.

As the Vaal River flows westward it flows into the Grootdraai Dam. This dam has a total storage capacity of 350 million cubic metres, a surface area of 39 square kilometres and an average depth of 27 metres. On its course to the Vaal Dam a number of rivers join the Vaal River:

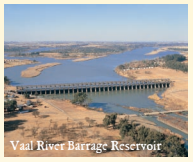

- the Little Vaal that begins in the escarpment near Ermelo;
- the Klip River that begins near Memel in the Free State;
- the Waterval River that begins in Secunda.

The Wilge River used to meet the Vaal River before the Vaal Dam was built but now flows straight into the Vaal Dam. This river begins in the escarpment near Harrismith. On its course to the Vaal Dam a number of other rivers flow into it, i.e. Nuwejaarspruit, Elands, and the Liebenbergsvlei rivers.

The Vaal River is one of the major rivers in South Africa but the runoff is not constant. This means that large dams have to be built in order to store water. In earlier times, many little dams were built to irrigate farms. These dams were the forerunners of the great barrages and dams which today control the river on which the gold fields of the Witwatersrand and the surrounding industrial complex depend so heavily.

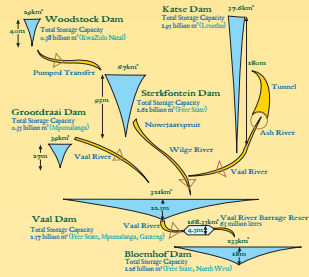
The Vaal Dam was built in the early thirties and was completed in 1938. The dam was built as a joint project between Rand Water and the then Department of Irrigation. At present Gauteng gets its water from the Vaal Dam, which is now managed by the Department of Water and Environmental Affairs. The Vaal Dam has a catchment area covering 38 505 square kilometres and a capacity to hold 2575 million cubic metres of water which, under normal circumstances and without a substantial inflow, will last for 2 years. This dam has a surface area of 321 square kilometres and an average depth of 22,5 metres. Even though the Vaal Dam is only the fourth largest dam in South Africa in terms of storage capacity, it is without a doubt the most important dam in view of its role as the primary supplier of water to the economic heartland of South Africa.


The present Vaal Dam wall has been raised twice. In the early fifties the wall was raised by 6.1 metres enabling it to store 2 188 million cubic metres. The ever increasing demand for water made it necessary for a further raising in 1985. The wall was raised by another 3,5 metres which increased the volume of the dam to 2 536 million cubic metres. The remaining 1,95 metres is used for temporary flood storage, which amounts to 662 million cubic metres.




The Vaal River Barrage Reservoir, created by a set of gates across the Vaal River, was built by Rand Water downstream of the Vaal Dam, in 1923. The reservoir is 64 kilometres long and has a total storage capacity of 63 million litres, a surface area of 168,35 square kilometres and has an average depth of 4,5 metres. The rivers, i.e. Suikerbosrant, Klip, & Rietspruit, that feed into the Vaal River Barrage Reservoir flow from industrial and heavily populated areas such as Johannesburg, Vereeniging and Sasolburg. This reservoir was used to supply water to the Witwatersrand but no longer does so because the quality of its water is deteriorating due to pollution. This reservoir is used for many recreational activities, such as boating, skiing, fishing, swimming and many holiday resorts have grown up on its banks.

The key to maintaining our water resources in a good state is effective management. This involves the monitoring of all our major rivers and dams, a task which involves regular sampling and analyses from over 140 points in Rand Water's catchment area, undertaken by Rand Water's Water Quality Specialist Services Department. Incorporated in the management of our water resources is the monitoring of wastewater from industries and municipalities.




When the water leaves the Vaal River Barrage Reservoir it meanders its way passed Parys, in the Free State, and then into the Bloemhof Dam. This dam has a surface area of 233 square kilometres, an average depth of 18 metres and a total storage capacity of 1,26 billion cubic metres. At Christiana there is a complex series of canals which takes water to 1200 farms in one of the largest irrigations schemes in the southern hemisphere. At Douglas the Vaal River meets the Orange River, 1200 kilometres from its source. The Orange River, which has its origin in Lesotho, then continues westward and eventually flows into the Atlantic Ocean at Alexander Bay.

## TRANSFER SCHEMES

Two water transfer schemes have been built to move water from other catchments to the Vaal Dam catchment in order to meet the demands of the growing Witwatersrand. These schemes include the following:

### 1. THE THUKELA-VAAL WATER TRANSFER SCHEME


This scheme is found in the Drakensberg and was completed in 1974. The Thukela River starts at Mont-aux-Sources, in the Drakensberg, and naturally flows through KwaZulu-Natal into the Indian Ocean. With the construction of the Thukela-Vaal Water Transfer Scheme, a certain amount of the water from the Thukela River is transferred via canals, pipelines and dams into the Vaal River system. The Thukela River flows into the Woodstock Dam (Surface Area: 29 square kilometres; Average Depth: 40 metres; Total Storage Capacity: 380 million cubic metres) and then into the Driel Barrage further downstream. A certain amount of water is pumped from the Driel Barrage into a canal which then flows via gravity into the Kilburn Dam. Water from the Kilburn Dam is then pumped underground, over the Drakensberg (500m), and into the Driekloof Dam. This section of the scheme is used to generate electricity as a hydroelectric power station has been built within the mountains of the Drakensberg. This power station, known as the Drakensberg Pumped Storage Scheme, is managed by Eskom and electricity that is produced here is fed into the national electricity grid. At peak periods (morning & afternoon) when electricity is needed, water is dropped from the Driekloof Dam, through the underground hydroelectric turbines, and into the Kilburn Dam. In quiet periods the water is pumped back from the Kilburn Dam and into the Driekloof Dam. When the Driekloof Dam is full water flows over a weir and into the Sterkfontein Dam, where it is stored. The Sterkfontein Dam has a surface area of 67 square kilometres, an average depth of 93 metres, and a total storage capacity of 2,61 billion cubic metres. When water is needed in the Vaal River System, water is released from the Sterkfontein Dam into the Nuwejaarspruit River, which then flows into the Wilge River and then into the Vaal Dam. As part of future plans for water management in South Africa the building of two further dams are planned for the scheme, i.e. Mielietuin Dam (30 million cubic metres) on the Bushman's River and Jana Dam (1500 million cubic metres) on the Thukela River which will have 121 km of pipelines that feed into the existing scheme.

### 2. THE LESOTHO HIGHLANDS WATER PROJECT

This scheme is found in the mountains of Lesotho. The mountains of Lesotho receive a great deal of water, in the form of rain and snow. Phase 1A of the project included the building of Katse Dam on the Malibamatso River.



The Malibamatso River flows naturally into the Senqu River and then into the Orange River. Water from the Katse Dam (Surface Area: 37,6 square kilometres; Average Depth: 180 metres; Total Storage Capacity: 1,95 billion cubic metres) is drawn into a tunnel via an intake tower that is situated upstream of the Katse Dam wall. The water travels along an underground pipe, 44,75 kilometres long, through the Muela Hydroelectric Power Station and into the Muela Dam. Here the water moves straight through the underground hydroelectric turbines to produce electricity for Lesotho. The water from the Muela Dam then travels along a 33,27 kilometre long underground pipe and finally flows into the Ash River, near Clarens in South Africa.

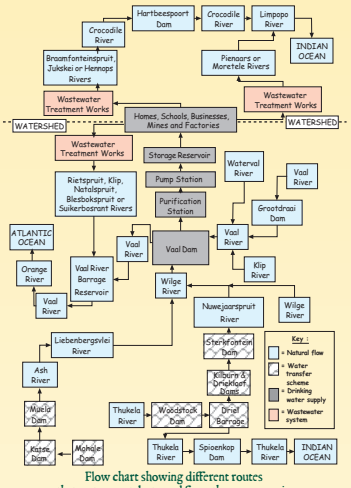
The Ash River then flows into the Saulspoort Dam. Thereafter the water flows into the Liebenbergsvlei River, the Wilge River and then into the Vaal Dam. Phase 1A of this project was completed in 1998. Phase 1B saw the building of the Mohale Dam as well as an underground transfer tunnel that leads into the Katse Dam. Phase 2 includes the building of a further 3 dams in Lesotho, namely the Polihali Dam, the Taung Dam and the Lebelo Dam, with underground pipelines feeding into the existing dams. Plans for the Polihali Dam are underway with construction starting in 2011 and completion in 2019, at an estimated cost of R7.3 billion.

## DRINKING WATER SUPPLY

Rand Water draws water for purification from the Vaal Dam. This water is transported via canals and pipelines to Rand Water's two purification stations in Vereeniging. Here the water is cleaned and treated to a standard suitable for humans to drink. The water complies with the requirements of the South African National Standard for Drinking Water (SANS 241) and the World Health Organisation (WHO) guidelines. The purified drinking water is pumped in underground pipelines from the purification stations, via a series of pump stations, stored in closed reservoirs and then distributed via underground pipes, using the force of gravity. Rand Water sells water to local authorities, and some mines and factories, in an area of 18 000 square kilometres. The local authorities then supply 11 million people in homes, schools, and businesses in Gauteng and parts of Mpumalanga, North West, Free State and Limpopo Provinces with clean water they buy from Rand Water. This accounts for 45% of the South African population and 60% of the economy.


## WASTEWATER

People use the drinking water for washing, cooking, gardening, manufacturing, drinking and flushing toilets. Dirty water that goes down the drains and toilets is called wastewater (sewage). In areas with a waterborne sewage system, wastewater is transported via sewerage pipes to wastewater treatment works. Here the wastewater is cleaned and treated to a standard set by the Department of Water and Environmental Affairs, before being discharged into the closest river. Treated wastewater from the northern side of the Witwatersrand watershed flows into rivers that drain into the Crocodile & Limpopo Rivers and on to the Indian Ocean. Treated wastewater from the southern side of the watershed flows into rivers that drain to the Vaal River Barrage Reservoir (downstream of the Vaal Dam), and then on to the Orange River and the Atlantic Ocean. In this way, the water is returned to the natural water cycle.




Flow chart showing different routes that water can take to and from the consumer in Rand Water's Area of Interest

## IS WATER FREE?

Water is freely available from the natural water cycle but due to water in South Africa being a scarce resource and often a polluted resource, many systems need to be put into place so that we receive enough clean healthy water, i.e. dams, water transfer schemes, water purification stations, reservoirs, pipelines, etc. These systems cost large amounts of money and this is why we have to pay for water. At the moment you pay between R4 & R16 for 1000 litres of tap water, which is very cheap compared to your grocery items. If we continue to waste and pollute water then that cost will drastically increase. More dams and water transfer schemes will have to be built, and further technology will have to be included in Rand Water's purification process, or further infrastructure built, to clean polluted water. South Africa also does not have the water available. That is why it is so important for people to change their attitude towards water, treat it with respect and use it WISELY. It is important that we all become WATER WISE!

To be "Water Wise" means that a person will:

- have the utmost RESPECT for water and all life;
- use water carefully and not WASTE it;
- not POLLUTE rivers with liquid and solid waste;
- PAY for water services;
- take ACTION to solve any water problems;
- CONSERVE water, and thereby CONSERVE the natural environment.

Water Wise

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For further information on the education services that Rand Water's Water Wise Education Team offers please contact 0860 10 10 60 or visit www.randwater.co.za