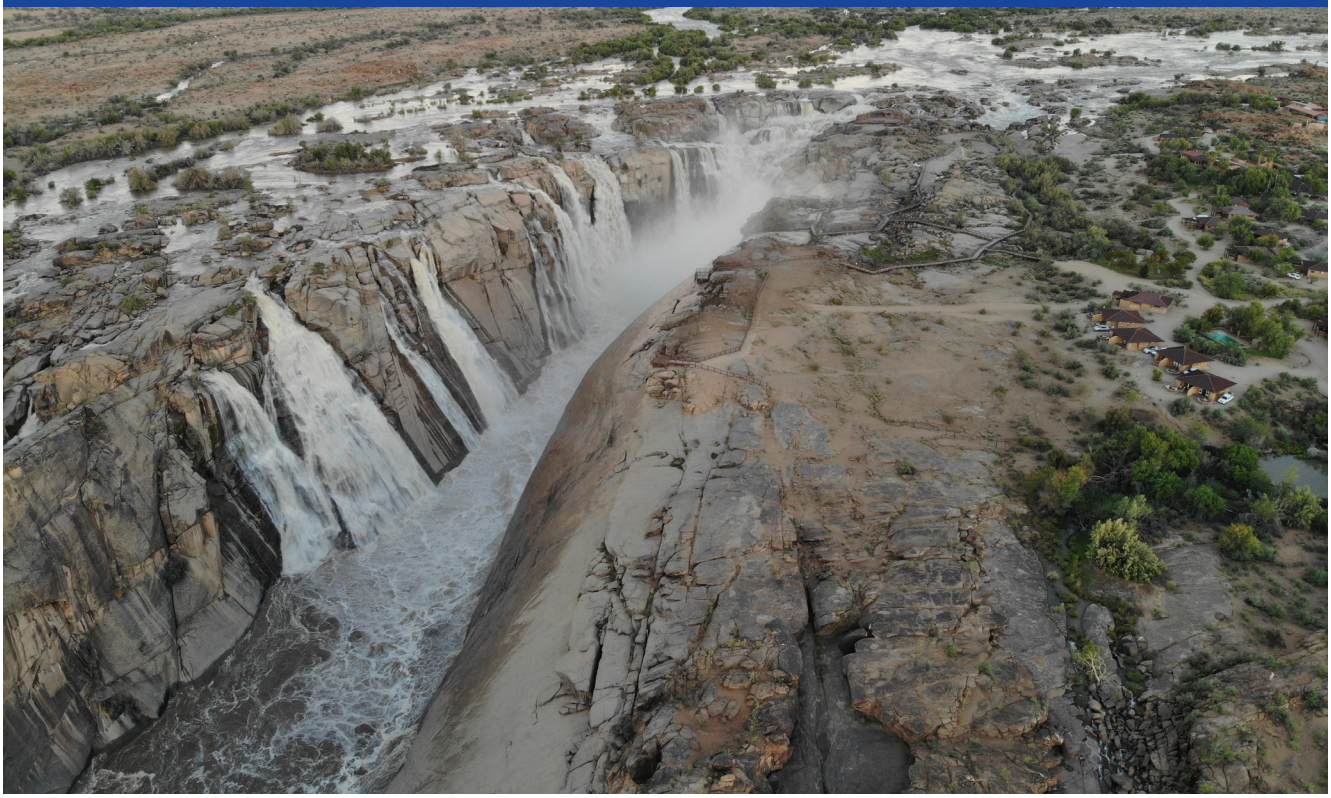
SOUTH AFRICAN RIVERS

Lower Orange's spectacular summer show draws attention to the plight of SA rivers

The Orange is a behemoth on any day but, this year, egged on by a second consecutive robust summer rainfall season in the catchment, the river's lower reaches roared into epic proportions. This, 2022, was the first year since 1988 that the river's flow reached over 3 000 cubic meters per second (cumecs) as it thundered over the enigmatic Augrabies Falls. The spectacle drew thousands of people to enjoy the show that Mother Nature put on but, the flow of the river today is as much a result of large-scale human engineering and activities, as it is of rainfall and climate. Petro Kotzé reports.



Hanno Langenhoven

According to a study published in ***Nature*** in 2019, only 37% of rivers longer than 1 000 kilometers remain free-flowing over their entire length, and only 23% flow uninterrupted to the ocean. Very long free-flowing rivers are today largely restricted to remote regions of the Arctic, the Amazon, and the Congo basins.

Intensely managed rivers like the Orange have become pillars of development in the vast tracts of land that they run through, and their management entails a balancing act of the needs of a large number and variety of users that depend on the river's water. As a result, and ironically for a country like South Africa so intimately associated with drought, high levels of flow in the Orange do not only bring blessings anymore. There are prices to pay too, as this summer rainfall season has shown. The mechanics behind the water that becomes both gift and curse as it traverses more than 2 000 km over the country, start in Lesotho.

The birth, and taming, of the Orange River

The source of the Orange River is officially recognised as the Senqu River, which rises on the Lesotho Highlands, about 3 300 metres above sea level. Although only about 3% of the Orange River Basin lies in Lesotho, the high mean annual rainfall in this comparatively tiny area contributes much of the Orange River's annual flow (figures vary from 40% to 60%). The contribution is astounding, taking in mind that the drainage basin of the Orange (together with its main tributary, the Vaal) is at least 855 000 m^2 in size.

As the river enters South Africa it flows south and west through open country and erodes in a broad valley almost 50 km wide and 300 m deep. The Caledon River joins as a tributary at what is now the head of the Gariep Dam, the largest storage reservoir in South Africa and the main storage structure on the Orange River. From here, water is supplied in two directions, southwards through the Orange-Fish tunnel to the Eastern Cape, and westwards, down the river to the Vanderkloof Dam. The river then swings northwest and is joined, at Douglas, by the Vaal River on which the Bloemhof and Vaal dams are main storage facilities.

The rainfall in the catchment of the upper Orange, and the management of dam sluices impact flow in the lower reaches of the river. In general, annual rainfall decreases as the river runs west, as temperatures (and evaporation) increases. This past December, on the back of a second La Niña event in two years, the South African Weather Service announced that the mid-summer season started off with above-normal rainfall over almost the entire country, which continued into January.

Serious rains arrived a little earlier than usual, and dams, especially Bloemhof, filled up and spilled in early December, as was expected, says Sputnik Ratau, media liaison for the Department of Water and Sanitation. Bloemhof Dam filled up on 8 December and rose to 110% but the level was reduced to below 104% through controlled releases ensuring that the flow downstream was not excessive, he reports. The highest average inflow into Bloemhof Dam this season so far occurred on 22 January, when it was about 2300 cumecs, a recurrence of about one in five years.

Ratau says the decision to open or close sluice gates is made on a balance of factors. "Ensuring the safety of the water infrastructure, that of communities downstream, and the need to ensure that the reservoirs are full (if they were likely to be) at the end of the rainfall season are the key objectives of our flood control operations." The decision on how much water to release from the dams, and when to do so, safely, without causing avoidable damage downstream, Ratau explains, is based on data from continuous real-time monitoring of river flow and dam levels that enables the calculation of the quantities and timing of inflow into the dams and the likely capacity increase.

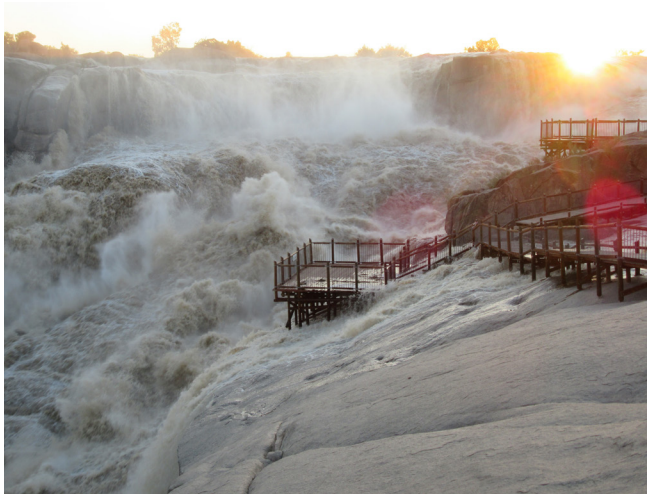
Ratau adds that some dams, including the Vaal and Bloemhof, have additional capacity above full supply level for limited flood control. This extra capacity (even the entire reservoir capacity) is, however, still too small to store all the water produced by most flood events.

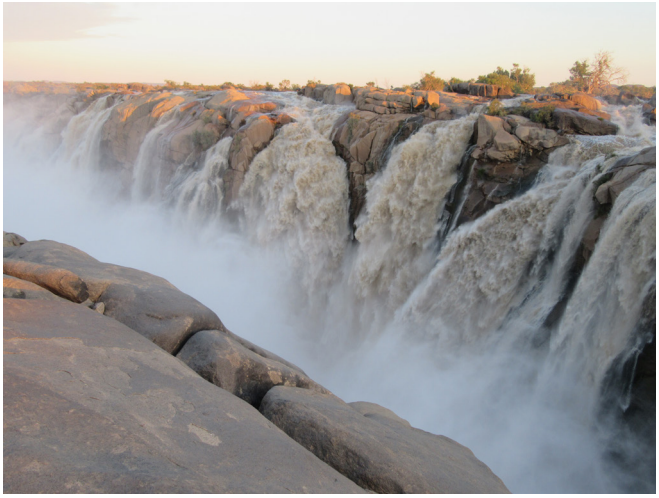
Still, though limited, this flood storage capacity can contain floods somewhat, as water can be released during significantly lower flow levels, delaying flow peaks to enable the evacuation of people and movable property. "This season, water was held in the Vaal Dam and Bloemhof Dam to ensure that it did not combine with about 2 000 cumecs outflow from Vanderkloof Dam (which has an uncontrolled spillway) and form a bigger flood in the Lower Orange. This ensured that the flow did not go much higher than 4 000 cumecs, which would have been the case otherwise." As the department cannot manage all risks with the available infrastructure, it also depends on legislation, early warnings, insurance, awareness, and preparedness to minimise impacts.

The highest flow this summer rainfall season (at the time of print) along the lower Orange was close to Prieska, below the dams, where the river bends sharply northwest. The flow at the Katlani, Prieska, and Upington gauging stations reached 3 800 cumecs, Ratau notes, a level with a return period of about 1 in 10 years. Water levels of this caliber are felt keenly by the surrounding agricultural community.

Flood in the lower Orange

The lower Orange River region, from around Groblershoop towards Upington is known for, among other crops, its sweet





SANParks

The Augrabies Falls put up a spectacular show when flow in the river reached record highs earlier this year.

Hanno Langenhoven

The Orange River in flood remains a sight close to South Africans' hearts.

grapes. This year's high flows saw a number of negative impacts on producers being reported on. These include overflowed drainage slopes and vineyards (blocks), at times, "knee-deep" in water. The conditions are conducive to diseases like downy mildew and white rust that led to fruit rot and, over and above that, it was reported that farmers could not reach some of the vineyards to apply pesticides. The vines can take up to two years to recover from the stress and produce optimally again. On the flipside, famers that decided to harvest earlier based on weather forecasts, will pay in the form of lower sugar content and lighter tonnage.

Onwards, about 30 km from Kakamas the river enters the Augrabies Falls National Park and tumbles down the iconic falls that the protected area is named after. Here, the increased flow has been welcomed with open arms. By and large, the impact on the park has been positive, says Genevieve Maasdorp, Communications Manager for the SANParks Arid Region, and, in some cases, even spectacular.

NASA/Flickr

For much of its lower reaches, the Orange River is a life-giving artery in an otherwise arid landscape.

Augrabies Falls – the place of great noise

Normally, visitors that enter the protected area through the main gate will not be aware that a river is flowing almost parallel with the entrance road but, during high flows as experienced this year, the broad river can be seen from the gate all the way to the rest camp. The noise of the gushing water is "tremendously loud" Maasdorp says and, together with the high levels of humidity, creates a very strange experience in the arid environment.

The park itself is actually in the grips of harsh, long-term drought, notes Maasdorp, and the surrounding parched veld is in strong contrast to the millions of litres of water that have flowed down the river and stormed over the series of rapids to plunge into the deep pool at the start of the near vertical-sided 20 km gorge.

The park's long-term average rainfall is only 125 mm per annum, and it decreased over a ten-year period from 125 mm to only 41 mm per annum in 2020, with the exception of a slight increase in 2012/13. In contrast, for the past two years, the river logged particularly high January flows. In January 2021 the flow was at 1 018.40 cumecs and, this year, 2 557cumecs. In comparison, the average flow for the five years from 2016 to 2020 was only 79.16 cumecs.

The highest flow on record was in 1974 at just over 8 000 cumecs, followed by 7 800 cumecs in 1988. At the time, the floods cut the park off for at least three weeks as the bridge outside the main gate was washed away. Since 1988, the Orange River flow here only topped 3 000 cumecs twice; in 2011 when

flow reached 4 776 cumecs and, this year, when flow reached 3 566 cumecs.

Once the numerous falls on the northern bank start tumbling down together with the main falls, Maasdorp says it creates immense amounts of spray. This year, the column of spray could be seen from the Augrabies town 15 km away. The spray lasted so long park management had to close a large lookout deck at the falls, which became green and slippery from being continuously doused in water. Spray and wind rose up with such force at the deck people couldn't look down with their eyes open.

When news starts to break that the Augrabies Falls is putting up a show, tourists flock to the park. From April 2019 to March 2020 when there was no exceptionally high flow, tourist numbers were 55 375. The following year (April 2020 to March 2021, when flow increased), 72 601 people visited. From April 2021 until mid-February 2022, over 87 000 people have visited the park (mostly South African citizens). The financial benefit to the park extends to the surrounding tourist accommodation facilities, which have benefited greatly from the overflow, Maasdorp says. More benefits have become the form of media and social media coverage – "very positive marketing that really puts the park on the map."

However, it's not all a proverbial walk in the park. Staff are pushed to the limit, and volunteers from the SANParks Honorary Rangers have to help with law enforcement duties. From about 2 600 cumecs, certain areas, including the day visitor area, have to be closed. The game area becomes inaccessible for sedan vehicles and the staff village is cut off from the shortest route to the reception area, adding time, kilometers, and fuel to expenses. Another major impact, Maasdorp notes, is the increased volume of waste left behind by tourists. Boundary fences that end in the river are also damaged.

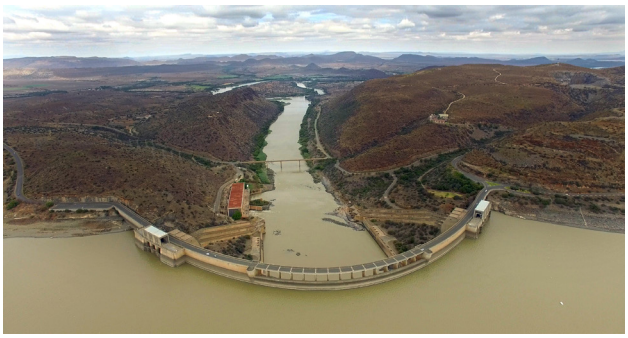
From about 3 100 cumecs the lower viewing decks have to be closed too. Management of water supply and infrastructure becomes crucial and "very time consuming". The park pump needs to be extracted every day, and rising water levels monitored constantly. When the flow reaches 3 500 cumecs, the pump is approximately 150 metres from its original position. During such high flows, the rest camp is also packed with tourists so water is used much more quickly and, as a result, does not have enough time to settle in the filters, resulting in discolouration.

The ideal is a peak at 2 500 cumecs, Maasdorp says, when the waterfalls are absolutely spectacular, but everything is still accessible – exactly what visitors want.

When business relies on flow – kayak trips

Further along the river, at Onseepkans, there lies the so-called gorge section, a popular strip for kayak tour operators. "Extremes in flow, both high and low, have a detrimental effect on our business," says Marie-Louise Kellett, co-owner and director of Gravity Adventures, which offers rafting trips in the Orange.

They cancelled their trips on the gorge during the drought that recently ended, because the water level became too low to run



Danie Swanepoel/Flickr

The Gariep Dam is not only the largest dam on the Orange River, but also the largest in South Africa. Water releases are carefully managed by the Department of Water and Sanitation to meet the needs of water users and the environment.

safe or enjoyable trips. They then started to run trips much further upstream, on the Thunder Alley section near Hopetown, she says, where the river is close to the outflow from Vanderkloof Dam. The capacity to run trips on two sections of the river has enabled them to be far more flexible, which was an advantage during the high flow period. "Whilst we cannot run trips on the gorge section below the confluence of the Vaal and the Orange (where the flow was still at about 1 600 cumecs at the time), we can usually run on the Thunder Alley section, where the river is far wider and more forgiving than the tight channels of the gorge section." However, Kellett says they still had to cancel three trips in January, when the flow was at its peak. Their cut-off on the gorge section is at about 500 to 600 cumecs, and on the Thunder Alley section around 1 600 cumecs.

The knock-on effects of cancellations for their business are significant. "Our guides are all freelancers so they lose income, and the decreased income to the business means we may have a lean winter period." In addition, their suppliers, such as catering and accommodation, also lose money.

Where the river meets the sea

The river meets the arid Atlantic coast a few kilometers north of Alexander Bay thousands of kilometers from its source in Lesotho. The Orange River mouth today is described as a "highly disturbed, modified ecological system as a result of years of degradation due to diamond mining activities, flow regulation of the river, and poor management of the mouth." It has been classified as an IBA or, an Important Bird and Biodiversity Area (a site of global significance for bird conservation) by BirdLife International and a Ramsar site in 1991 (as was the Namibian side of the mouth in 1995) but, in 1995 the South African portion was placed on the Montreux Record – a list of Ramsar wetlands in need of urgent conservation action. Among the numerous conservation issues at play is increasing stress due to the increased demand for water from the Orange River for people, industries and agriculture. The Orange River remains a crucial life artery for South Africa.

References: In the footsteps of giants – Exploring the history of South Africa's large dams, by Lani van Vuuren
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