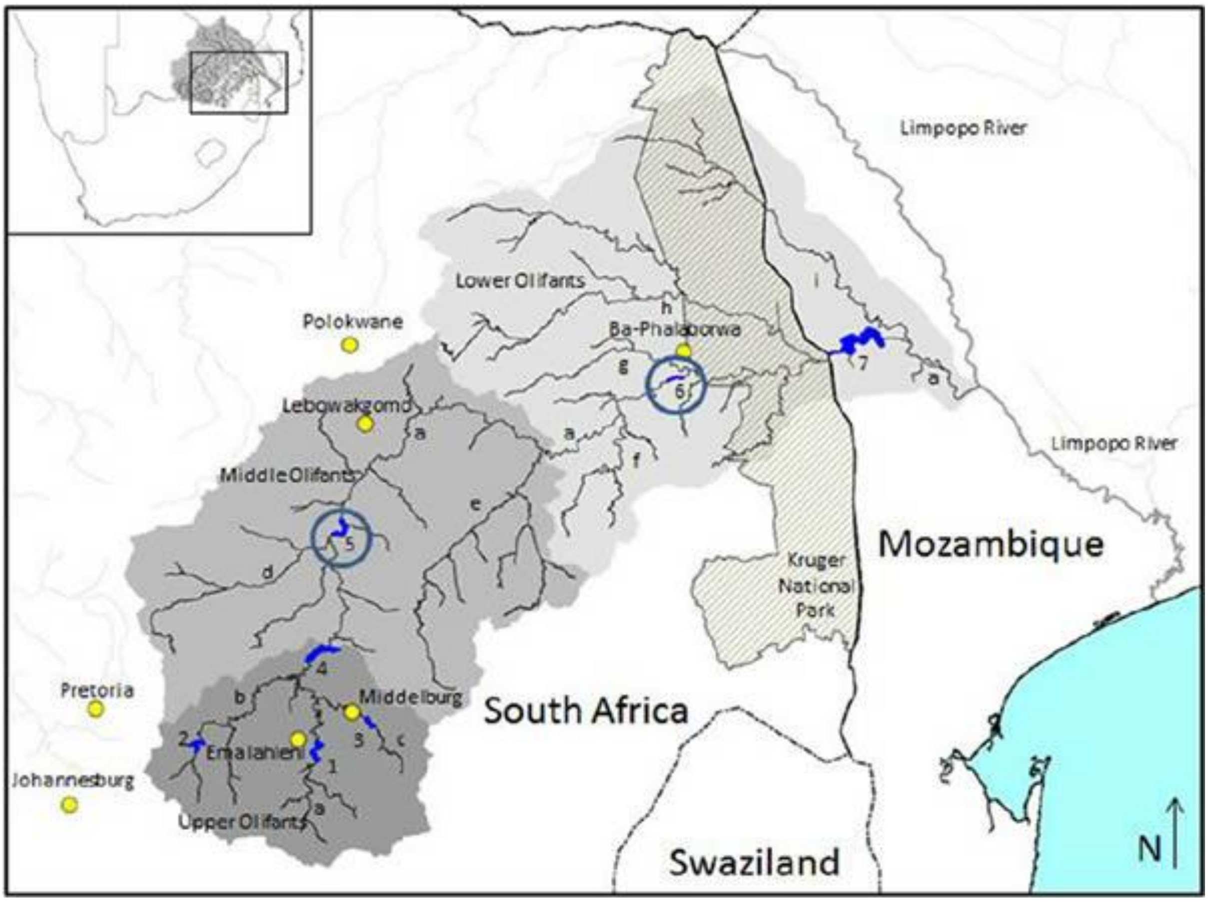
OUR BEAUTIFUL OLIFANTS RIVER

Freek Venter, June 2020

We at Grietjie are really privileged to have the Olifants River at our doorstep and that we have the opportunity to enjoy its beauty! The Olifants is one of seven major rivers which flow in an easterly direction through the Lowveld, the Kruger National Park (KNP) and into Mozambique. All these rivers, except the Limpopo and Olifants, originate in the high rainfall areas in the Drakensberg Escarpment to the west of us. Rainfall in these areas can be as high as 2000 mm per year. The escarpment areas are relatively small "water factories" that generate over 90% of the water in Kruger's rivers.

These rivers are crucially important for the conservation of the unique natural environments of the private reserves and the KNP. But, because rivers are long, thin ecosystems that cross many different landscapes and are exploited extensively by a myriad users, they are particularly difficult to manage and protect. The previous South African water act provided only for human use, agriculture and mining. Water running down a river channel specifically to conserve the unique river ecosystem was seen as a waste of water by the old hands!

The Olifants River originates in the pollution mecca of South Africa near the towns of Bethal, Middelburg and Emalahleni (Witbank). It drains a massive catchment area of 54 575 km^2 and flows for more than 560 km, of which more than 100 km in the KNP before entering Mozambique. The Mean Annual Runoff (MAR) of the Olifants is 2 400 $x10^6$ m^3.



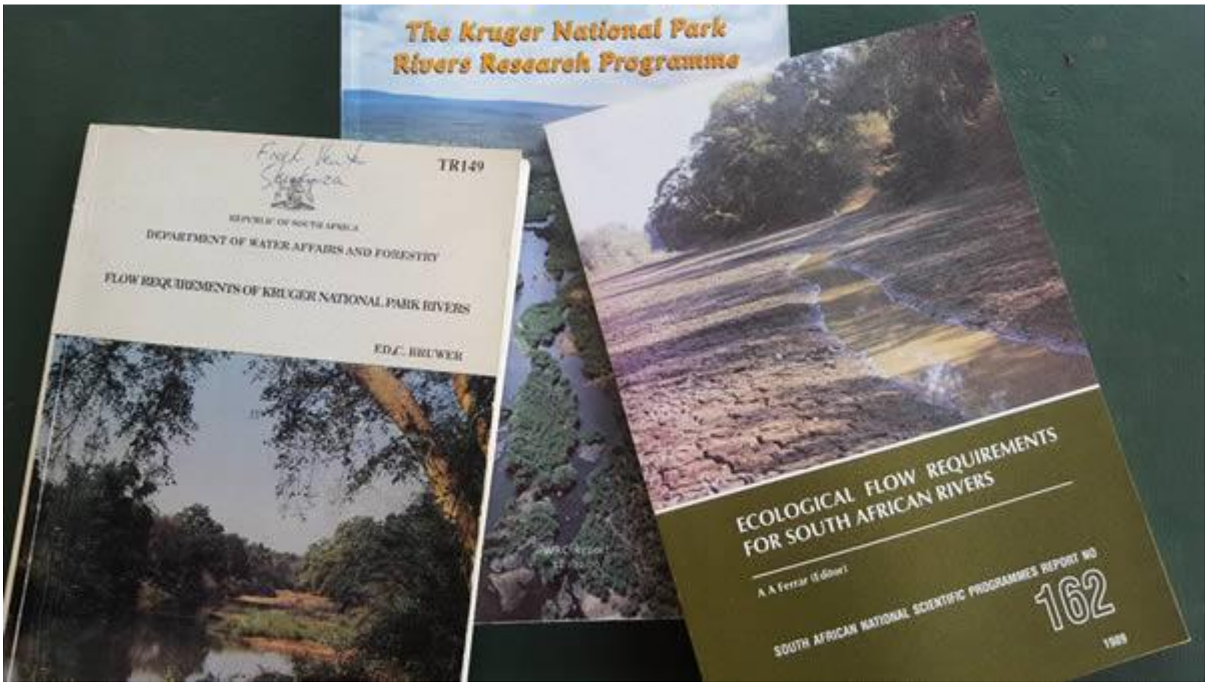
Map of the Olifants River system showing the location of major towns, impoundments and tributaries. Major impoundments are depicted by numbers: (1) Witbank Dam, (2) Bronkhorstspruit Dam, (3) Middelburg Dam, (4) Loskop Dam, (5) Flag Boshielo Dam, (6) Phalaborwa Barrage and (7) Massingir Dam. The Olifants River and its tributaries are depicted by letters: (a) Olifants mainstem, (b) Wilge, (c) Klein Olifants, (d) Elands, (e) Steelpoort, (f) Blyde, (g) Ga-Selati, (h) Letaba and (i) Shingwedzi. Ttwo dams of importance to us that are not shown on this map are Blyde and De Hoop (Steelpoort River).

Between the KNP western boundary and the main KNP tar road at the Olifants high level bridge is a massive wilderness area that is currently used for the Olifants Backpack Trail.

The Olifants Backpack Wilderness Trail runs along the western part of the Olifants River in the KNP. The trail stretches over 4 nights/5 days and covers a distance of 65 km. Each hiker must carry his own *food, water, bedding, tent and clothes. It is a no-trace, pack-it-in/pack-it-out trail. Every morning the ashes of the small fire used for cooking the previous night is mixed with soil and spread out in the bush, and the fireplace covered with soil so that the next group that arrives 2 days later will not even notice that another group used the site.*

On the eastern boundary of the KNP the river have cut an incredibly beautiful gorge through the Lebombo Mountains. One of the biggest crocodile populations in SA used to occur in this gorge. The deep pools and rapids used to accommodate big fish populations on which the crocodiles fed. Unfortunately the Massingir Dam in Mozambique pushes back into this gorge. It has decimated at least 6 of the 8 km long gorge by filling it up with fine sediments containing the pollutants coming out of SA. This has killed many crocodiles in that area.

The problems related to overuse started for the KNP rivers in the 1960's and 70's when once perennial rivers such as the Letaba stopped flowing during winter months of dryer years. In the early 1980's the KNP started to address this issue seriously. The engineers in the Department of Water Affairs (at that stage one of the top departments in the country) needed figures to plan how much water must be set aside for nature, especially in new dams they were planning to build. At that stage nobody knew how much water is necessary to maintain ecological integrity in a river.



The KNP Rivers Research Programme, jointly funded by the CSIR's Foundation for Research Development, the Water Research Commission, Water Affairs and SANParks was subsequently launched. Twelve years of intense study on all the different aspects of rivers followed, involving many scientists and students from all over SA and the world. The studies included: river hydrology and geomorphology, sedimentation, riparian vegetation, fish communities, macro invertebrates and human wellbeing, to name a few.

To monitor the flow in the rivers, gauging weirs were built in all the rivers as close to the KNP western boundary as possible. Downstream from the Olifants/Selati confluence, a few kilometers into Kruger, is the Mamba gauging weir. It is fitted with instruments that make it an online weir, meaning the KNP can see what is going on there by logging into Water Affairs' website. The gauging weir that is important for Grietjie to keep an eye on the Olifants flow is Oxford, the one beneath the train bridge at Three Bridges.

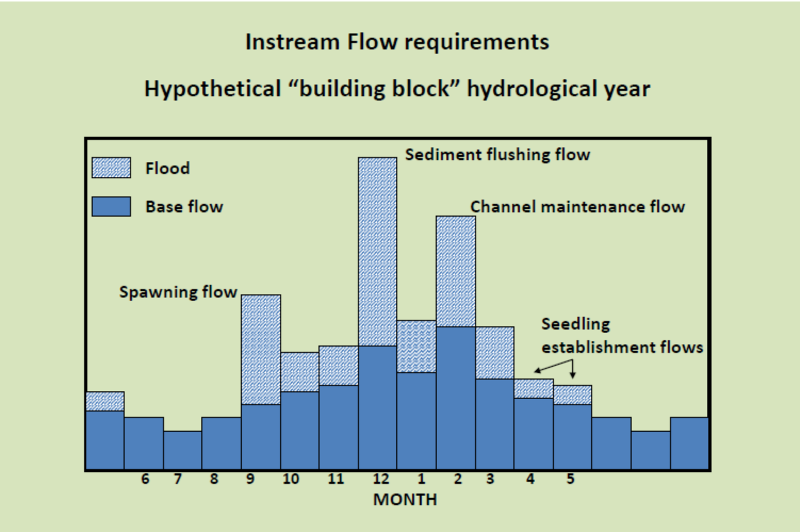
The KNP river management process also required that the KNP build strong relationships with people in the catchments as well as departments involved with the rivers . The rivers research program culminated in more than science or actively managing the rivers – it became a social process in the spirit of give and take, and tradeoffs were the name of the game. Two important citizen-based organisations that sprang out of these dealings were the Sabie River Working Group (chaired by Japie Lubbe – an irrigation farmer along the Sabie River) and Bielie van Zyl (involved with the coal mining industry in the upper Olifants). Both these organisations made huge differences towards the eventual success of the program.

Kruger National Park Rivers Research Programme
Nasionale Krugerwildtuin Riviere Navorsingsprogram

OLIFANTS RIVER FORUM

Not only did the program produce the much-needed information to base water allocations for natural systems on, but it also created a community of scientists, officials, lawyers, farmers, and industrialists that continued to make a difference in many areas in South Africa and even the rest of the world for decades after the program ended..

A group of river scientists during a field trip near Skukuza (circa early 1990's). The two ladies in front are Prof Tally Palmer (in white jacket) and Dr Jackie King (with red hair and sunglasses). Jackie developed and published a method by which water allocations for rivers could be determined, called the Building Block Method (BBM). It has been extensively used to determine the Environmental Reserve for KNP rivers and all over South Africa. Jackie raked in the WWF–SA Living Planet Award as well as a Southern African Society for Aquatic Sciences (SASAQS) Gold Medal for her work. Tally, with the assistance of Adv. Junod on the far right, served on Kader Asmal's ministerial committee during the drafting of the new water act. They were responsible for getting the Environmental Reserve embedded in the National Water Act (Act No. 36 of 1998) and thereby legislating water rights for nature, a ground-breaking achievement and first for the world. She was awarded the SASAQS Silver and Gold Medals and The Rhodes University Vice Chancellor's Excellence award in Engaged Research.



To be able to use the BBM method it is necessary to survey sections of a river in detail. For example a section like this in the Olifants Wilderness area will be chosen because it contains several important habitat types: rapids, riffles, a deep slow flowing pool, rock banks, sandy beaches and reed fringes (in the background).

Several cross sections from bank to bank are surveyed, and the average downstream slope of the river is determined, to give a 3-D view of the section. With this knowledge the amount of flow needed to maintain a certain depth in specific parts of the river can be calculated.

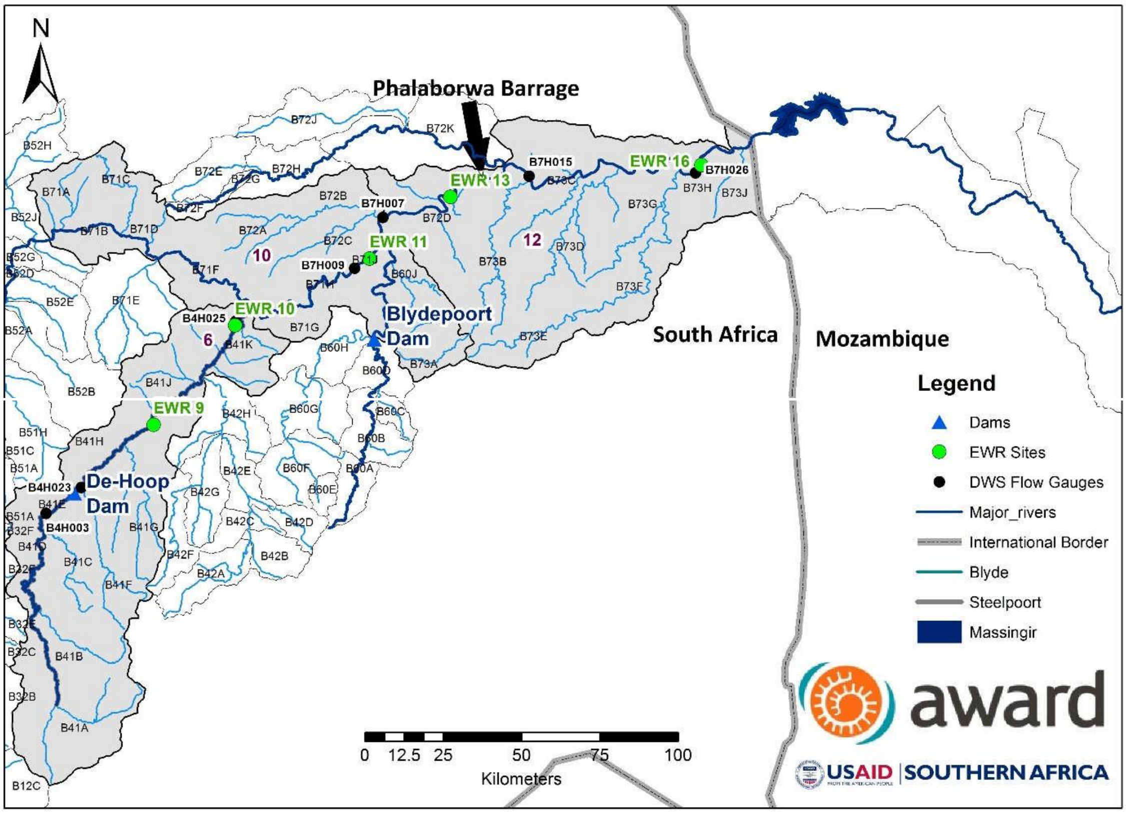
When a river stops flowing, the lowest sections of riffles and rapids are the first to dry up, and because they provide habitat to a number of fish and macroinvertebrate species that occur only in those kind of habitat and nowhere else, a whole subgroup of the river's biota is wiped out in one go if a perennial rivers stops flowing.

It took the Department of Water and Sanitation many years to eventually get all their ducks in a row, and eventually, on 22 April 2016, Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment was published in the Government Gazette (see excerpt below, and I am sorry for the small print but if you are interested go and check it out at the website given in the references section below).

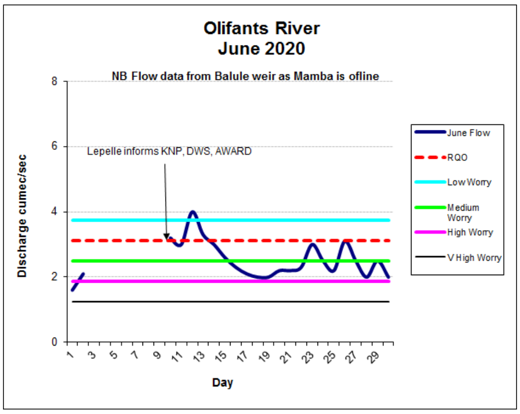
This means that the Department of Water Affairs is now legally bound to ensure that the minimum flows for the Olifants River are provided. Kruger's River Management team developed a system by which the river is monitored on a daily basis. The EWR site No 13 is on Grietjie (see map below) and was surveyed in 2001. Therefore, flows in the river at Grietjie are also determinants for the management of the Environmental Reserve of the Olifants River.

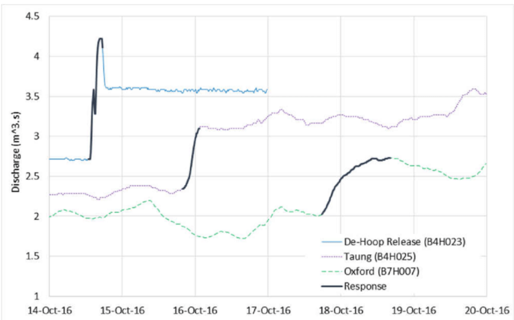
RIVER WATER QUANTITY													
IUA	Class	River	RU	Biophysical Node Name	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits			
									VMAR = 1755.5x10⁶m³ PES=C category	Nov	8.016 (70)	2.978 (99)	3.383 (99)
										Dec	9.747 (70)	3.573 (99)	5.806 (90)
										Jan	11.956 (70)	4.341 (99)	3.425 (99)
										Feb	15.848 (70)	5.713 (99)	12.616 (90)
								High flows must provide for the ecosystem.		Mar	14.484 (70)	5.219 (99)	3.425 (99)
										Apr	13.039 (60)	4.724 (99)	1.824 (99)
										May	10.333 (60)	3.777 (99)	
										Jun	8.401 (60)	3.112 (99)	
										Jul	6.783 (60)	2.543 (99)	
										Aug	5.729 (70)	2.177 (99)	
										Sep	5.194 (60)	1.997 (99)	
11	III	Ga-Selati (EWR site - EWR14b) (existing)	RU103	103	D	Quantity	Low Flows	Low flows are important for the maintenance of the ecosystem.	EWR maintenance low and drought flows: Ga-Selati EWR14b in B72K VMAR = 72.74x10⁶m³ PES=D category	Maintenance low flows (m³/s) (Percentile)			Drought flows (m³/s) (Percentile)
										Oct	0.122 (70)		0.001 (99)
										Nov	0.138 (60)		0.001 (99)
										Dec	0.192 (60)		0.001 (99)
										Jan	0.350 (50)		0.001 (99)
										Feb	0.744 (60)		0.003 (99)
										Mar	0.608 (50)		0.003 (99)
										Apr	0.378 (70)		0.002 (99)
										May	0.200 (70)		0.001 (99)
										Jun	0.178 (70)		0.001 (99)
										Jul	0.156 (70)		0.001 (99)
										Aug	0.141 (70)		0.001 (99)
										Sep	0.132 (7)		
	III	Ga-Selati (outlet of quaternary - outlet of IUA 11)	RU104	104	D	Quantity	Low Flows	Low flows are important for the maintenance of the ecosystem.	EWR maintenance low and drought flows: Ga-Selati EWR14b in B72K VMAR = 72.74x10⁶m³ PES=D category	Maintenance low flows (m³/s) (Percentile)			Drought flows (m³/s) (Percentile)
										Oct	0.122 (60)		0.001 (99)
										Nov	0.138 (60)		0.001 (99)
										Dec	0.192 (60)		0.001 (99)
										Jan	0.350 (50)		0.001 (99)
										Feb	0.744 (60)		0.003 (99)
										Mar	0.608 (50)		0.003 (99)
										Apr	0.378 (70)		0.002 (99)
										May	0.200 (60)		0.001 (99)
										Jun	0.178 (70)		0.001 (99)
										Jul	0.156 (70)		0.001 (99)
										Aug	0.141 (70)		0.001 (99)
										Sep	0.132 (70)		
12	II	Olifants (EWR site - EWR13) (existing)	RU105	105	C	Quantity	Low and High Flows	Low flows must be improved to maintain ecosystem structure and function.	EWR maintenance low and high flows and drought flows: Olifants EWR13 in B72B VMAR = 1762.2x10⁶m³ PES=C category	Maintenance low flows (m³/s) (Percentile)		Drought flows (m³/s) (Percentile)	Freshets (m³/s) (Percentile)
										Oct	3.940 (70)	2.149 (99)	0.598 (99)
										Nov	5.692 (70)	2.979 (99)	3.093 (99)
										Dec	6.802 (80)	3.576 (99)	5.317 (90)
										Jan	8.351 (70)	4.347 (99)	3.141 (99)

RIVER WATER QUANTITY													
IUA	Class	River	RU	Biophysical Node Name	REC	Component	Sub Component	RQO	Indicator/ measure	Numerical Limits			
										Feb	10.994 (70)	5.683 (99)	11.515 (90)
								High flows must be maintained to support ecosystem structure and function.		Mar	10.125 (70)	5.231 (99)	3.141 (99)
										Apr	9.105 (70)	4.729 (99)	1.665 (99)
										May	7.209 (70)	3.778 (99)	
										Jun	5.880 (70)	3.112 (99)	
										Jul	4.732 (70)	2.544 (99)	
										Aug	3.998 (70)	2.179 (99)	
										Sep	3.625 (70)	1.999 (99)	
	II	Olifants (outlet of quaternary - outlet of IUA 12)	RU116	116	C	Quantity	Low and High Flows	Low flows must be maintained for ecosystem structure and function.	EWR maintenance low and high flows and drought flows: Olifants EWR16 in B73H VMAR = 1918.3x10⁶m³ PES=C category	Maintenance low flows (m³/s) (Percentile)		Drought flows (m³/s) (Percentile)	Freshets (m³/s) (Percentile)
										Oct	3.785 (70)	1.762 (99)	0.478 (99)
										Nov	5.335 (70)	2.426 (99)	2.502 (99)
										Dec	6.544 (70)	2.935 (99)	4.432 (90)
										Jan	8.179 (70)	3.630 (99)	2.765 (99)
										Feb	11.144 (70)	4.905 (99)	10.622 (90)
										Mar	10.150 (70)	4.468 (99)	2.765 (99)
								High flows must be maintained for ecosystem structure and functioning.		Apr	8.945 (70)	3.960 (99)	1.391 (99)
										May	6.942 (70)	3.104 (99)	
										Jun	5.614 (70)	2.545 (99)	
										Jul	4.545 (70)	2.085 (99)	
										Aug	3.851 (70)	1.790 (99)	
										Sep	3.500 (70)	1.646 (99)	
13	I	Blyde (inflow to Blydervierpoort Dam - outlet of IUA13)	RU121	121	B	Quantity	Low and High Flows	Lows flows are essential for protection of this ecosystem.	EWR maintenance low and high flows and drought flows: Blyde River in B60D VMAR = 283.9x10⁶m³ PES=B category	Maintenance low flows (m³/s) (Percentile)		Drought flows (m³/s) (Percentile)	Freshets (m³/s) (Percentile)
										Oct	1.559 (60)	0.512 (99)	0.091 (99)
										Nov	1.776 (60)	0.573 (99)	0.436 (99)
										Dec	2.036 (60)	0.638 (99)	0.996 (99)
										Jan	2.550 (60)	0.774 (99)	1.390 (90)
										Feb	3.534 (60)	1.044 (99)	5.124 (80)
										Mar	3.408 (60)	1.000 (99)	1.390 (99)
								High flows are essential to maintain the protected status of this ecosystem.		Apr	3.230 (60)	0.957 (99)	1.139 (99)
										May	2.793 (60)	0.836 (99)	
										Jun	2.546 (60)	0.776 (99)	
										Jul	2.076 (70)	0.648 (99)	
										Aug	1.776 (70)	0.569 (99)	
										Sep	1.632 (70)	0.534 (99)	



The Lower Olifants River Basin. The key Environmental Water Requirement (EWR) sites (where compliance against the nationally determined benchmark can be monitored) that are near a gauge station are indicated. Flows at EWR 16, as the most downstream site, effectively drive the EWR system. Note that B7H015 (Mamba) is the gauge against which EWR compliance is tracked (from Riddell *et al* 2016).





A system was devised by which flow in Kruger's rivers is monitored and managed. This graph for last month for the Olifants River was kindly provided by Jacques Venter, the KNP's river bio-technician responsible for keeping an eye on river conditions. The graph shows that action has already been taken to increase flow in the river to get to the Resource Quality Objective (RQO).

Reporting of non-compliance is escalated up the hierarchy of officials, ending with the minister when the very high worry level is reached. For example, the graph below (Riddell et al 2016) shows effects on the river flow downstream from De Hoop Dam after a release during the 2016 drought.

Next time when you enjoy a sundowner with a beautiful view on the banks of Olifants River, spare a thought for the big team of people and many years of science crafting, learning-by-doing, engineering skills, building relationships and applying vigilant pressure and diplomacy, that eventually led to the legislation and policies that allow us to protect the Olifants River as good as we can today.

Cheers!

References

BIGGS, H. & ROGERS, K.H., 2003. An adaptive system to link science, monitoring and management in practice, in J.T. du Toit, K.H. Rogers & H.C. Biggs: *The Kruger Experience: Ecology and management of savanna heterogeneity*, pp. 59−80, Island Press, Washington DC.

BREEN, C., DENT, M., JAGANYI, J., MADIKIZELA, B., MAGANBEHARIE, J., NDLOVU, J., *et al*. 2000. The Kruger National Park Rivers Research Programme. Final report, Water Research Commission, Pretoria.

GOVERNMENT GAZETTE No. 39943, 2016. Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment. *National Water Act, 1998 (Act No.36 Of 1998)*. Department of Water and Sanitation, South Africa.

https://www.researchgate.net/figure/Map-of-the-Olifants-River-system-showing-the-location-of-major-towns-impoundments-and_fig1_271701513

KING, J.M., THARME, R.E. & DE VILLIERS, M.S. (EDITORS) 2008. Environmental Flow Assessments for Rivers: Manual for the Building Block Methodology. *Water Research Commission Report No TT* 354/08.

O'KEEFFE, J.H. & DAVIES, B.R. 1991. Conservation and management of the rivers of the Kruger National Park: suggested methods for calculating instream flow needs. *Aquatic Conservation: Marine and Freshwater Ecosystems* 1: 55-71.

RIDDELL, E., RETIEF, H., POLLARD, S. & MOHLALA, T. 2016. Drought mitigation for water security: Interim Operating Rules for the Lower Olifants River. *Progress and Reflection Report by SANParks and the Association for Water and Rural Development (AWARD).*

ROGERS, K. & BESTBIER, R. 1997. Development of a protocol for the definition of the desired future state of riverine systems in South Africa. *South African Department of Environmental Affairs and Tourism*, Pretoria.

VENTER, F.J. & DEACON, A.R. 1995. Managing rivers for conservation and ecotourism in the Kruger National Park. *Water Science and Technology* 32, 227−233.

VENTER, F.J., NAIMAN, R.J., BIGGS, H.C. & PIENAAR, D.J. 2008. The Evolution of Conservation Management Philosophy: Science, Environmental Change and Social Adjustments in Kruger National Park. *Ecosystems* 11, 173−192.

WATER RESEARCH COMMISSION, 2001. *State of the rivers report. Crocodile, Sabie- Sand and Olifants river systems.* Pretoria, Water Research Commission**:** pp. 40.