Mpumalanga wetland rehab partnership a win for ecological infrastructure

In one of the most intensively mined areas in South Africa, a unique public-private partnership is illustrating the wonder of nature in mitigating the impact of anthropogenic activity on the country's water systems. Article by Lani van Vuuren.

Dr Paul Oberholster (standing) and Arno de Klerk of CSIR Natural Resources and the Environment during a post-rehabilitation site visit of the Zaalklapspruit wetland.

South Africa's wetlands are arguably its most valuable ecological infrastructure. Not only do these special ecosystems support water resources by purifying water and regulating flows, they also act as sponges that store water and release it slowly, filtering pollutants and reducing the impacts of droughts and floods in the process. Sustaining a rich diversity of faunal and floral species, wetlands also support the economic activities of many rural communities, including the provision of food and fuel.

Wetlands have become South Africa's most threatened ecosystem. Although no comprehensive national survey of wetland loss has been undertaken, studies in several major catchment have revealed that between 35% and 60% of the wetlands, and the benefits they provide, have been lost of severely degraded. It is likely that the extent of wetland loss, due to human activities such as urban and industrial development, as well as agricultural and other poor land management practices, for South Africa as a whole lies within this range.

In the Mpumalanga Highveld – the traditional heart of South Africa's coal industry – wetlands and mining have long been thought to be mutually exclusive. Up to 80% of the country's coal is mined here, often to the detriment of the region's wetlands. This is because wetlands are frequently found in the lowest lying parts of landscapes, which also provide the cheapest and easiest access to coal seams using opencast techniques. This results in the inevitable destruction of these ecosystems during the mining process. Mining also impacts wetlands in other ways, for example, through the release of polluted mine-water, as well as the diversion of surface water and alterations to groundwater.

SANBI Director: Ecological Infrastructure, John Dini, Coaltech Board member, Henk Lodewijks, and Arno de Klerk and Dr Paul Oberholster of the CSIR discussing the improved functioning of the wetland.

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Ironically, current research in the Upper Olifants River catchment, where coal-mining takes place, has shown that wetlands can play an important role in mitigating the impact of polluted water entering the catchment. With the value of wetlands as a natural resource being increasingly realised, regulators are now insisting that mines avoid, minimise and, in some cases, offset, their impacts on wetlands, and internalise the broader socio-economic and environmental costs of wetland loss into their balance sheets. As a result, the coal mining sector has realised that it needs to proactively and systematically address the business risk posed by its impact on wetlands.

This has sparked a partnership between the CSIR, the South African National Biodiversity Institute (SANBI), the Working for Wetlands (WfWET) programme of the Department of Environmental Affairs, the Water Research Commission (WRC) and major coal producers through the Coaltech Research Association to limit and mitigate the sector's impact on the catchment's wetlands. This partnership is currently taking the form of a co-funded, three-year research project under the auspices of Coaltech. According to the CSIR Natural Resources and the Environment (NRE) researcher, Arno de Klerk, due to the importance of the coal sector to the economy of South Africa it makes more sense to work with the sector towards mutually beneficial solutions rather than to expect the cessation of coal mining in the area altogether.

"The importance of coal as a strategic resource to South Africa cannot be denied. Not only does coal account for the vast majority of the country's energy production, the coal-mining industry also directly employs over 50 000 people. In the absence of large-scale renewable energy developments the expansion of coal-mining activities are bound to continue in the foreseeable future. This makes it important for us to work together to ensure that these activities continue as environmentally responsible as possible."

IDENTIFICATION OF HIGH RISK WETLANDS

At the time of writing, the project team was in the final stages of developing an atlas that identifies which wetlands are of particularly high value from a biodiversity or ecosystem goods and services perspective in the coalfields of the Mpumalanga Highveld. The project is bringing together, in a user friendly way, the potentially confusing array of biodiversity data that regulators expect mining houses to consider when they are planning

and implementing a mine. This includes data on threatened habitats, special wetland types, threatened species, protected areas, priority areas from the new provincial conservation plan, and sites identified for the expansion of protected areas.

A separate project, funded by the WRC, is refining the mapping of wetlands in Mpumalanga. This revised data is expected to be available later this year, and will improve the quality of data available for decision-makers in the province. "Although site level mapping and confirmation of exact areas will always be required, the refined datasets will significantly improve accuracy and reduce uncertainty in planning processes," notes de Klerk.

ZAALKLAPSPRUIT WETLAND

Another endeavour stemming from this research partnership is a case study on the rehabilitation of the Zaalklapspruit Wetland system. The main aim of the project is to determine the effectiveness of wetland rehabilitation in restoring the water treatment functions of the wetland (specifically related to mining-related pollutants).

"Wetlands provide more ecosystem services per hectare than any other ecosystem, being sites of intense biogeochemical activity that play an important role in improving water quality," explains de Klerk. "A wetland consists of various levels of organisations working together, which leads to improved water quality. In order to understand how to improve the functioning of a system, we need to understand how these various levels work together and how rehabilitation can improve them. The knowledge gleaned through this research could assist greatly in restoring the upper Olifants River catchment."

Finding a suitable site for rehabilitation in the catchment was a challenge in itself. De Klerk explains that the project team required a site that fulfilled a number of different criteria, including the type of wetland, level of impact, rehabilitation feasibility and landowner willingness (since most wetlands are located on farm land). After various site visits, discussions and deliberations the team settled on a site forming part of the Zaalklapspruit Wetland system. Measuring around 139 ha in size, this piece of the Zaalklapspruit Wetland is a naturally un-channelled valley bottom wetland system (a critically endangered wetland type) near Witbank in the upper Olifants River catchment. The wetland is located downstream of coal mines and is subject to typical acid mine drainage issues. The water quality through the wetland is generally very poor, having high levels of dissolved metals and low pH.

Lani van Vuuren

One of the concrete structures constructed in the wetland.

Before rehabilitation, the ecological integrity of the Zaalklapspruit Wetland system had been severely impacted by agricultural activities, which resulted in a major incised channel running through the centre of the wetland. This channel, together with drainage associated with historic ridge and furrow cultivation in the central area of the wetland caused canalised flow and compromised the wetland's water quality enhancement function.

Lani van Vuuren

The rehabilitation of the Zaalklapspruit wetland has improved its ability to treat polluted water from industrial and mining activities.

Rehabilitation activities, funded and undertaken by WfWET, focused on restoring the impacted landscape, removing channels, ridges and furrows. This raised the water table, and slowed down the water flow, allowing water to distribute across the width of the wetland again rather than racing through the centre.

Provincial WfWET coordinator for Mpumalanga, André Beetge, explains that rehabilitation was an expensive process involving extensive engineering, including the construction of several broad, low concrete structures, earth berms, and weirs. Due to the acidic and corrosive nature of incoming water flow, the project had to make use of concrete structures rather than the preferable wire gabion structures favoured in wetland rehabilitation. These man-made structures have been designed to be filled up naturally with plants and sediments over time.

IMMEDIATE RESULTS

The Zaalklapspruit Wetland showed almost immediate improvement following its makeover. At the time of writing, the project team had only just started with post-rehabilitation monitoring (after having completed an intensive pre-rehabilitation survey to establish baseline conditions), but preliminary results were promising. "We have been pleasantly surprised by some of the results. We are already seeing an increase in pH levels in the water flowing through the wetland, as well as a decrease in dissolved metals," notes de Klerk. "The biggest test now will be to see whether the improved functioning of the wetland is sustainable."

There is hard work ahead for the project team as they now look deeper into the ecological functioning of the wetland system to determine exactly what and how its biological functions have been altered through rehabilitation. "Above all, we need to determine the sustainability of this improvement," says CSIR principal researcher, Dr Paul Oberholster. "While this currently falls outside the current duration of the project, we are in discussion with various stakeholders to monitor the wetland for a longer period of time."

GUIDELINE FOR THE FUTURE

The project team is quick to point out that while wetlands are incredible natural resources they are not 'miracle workers' that have unlimited capacity to clear all pollution in a catchment. "An improved wetland, such as Zaalklapspruit, can only do so much in terms of improving water quality. All water users in a catchment have the responsibility to minimise their impacts on the system by ensuring their discharge comply with legal requirements," says Director for Ecological Infrastructure at SANBI, John Dini. "In an ideal situation a wetland should only be relied upon to do the 'final polishing' in terms of water quality, and in this way save downstream municipalities, and industries millions of rands that would otherwise have been spent to treat the water. These types of passive methods are ideal for dealing with smaller-scale impacts, e.g. the many older, ownerless and derelict mines which have fallen by default to the state to deal with where we need lower cost and low maintenance options for dealing with this."

While it is still early days the project team is hopeful that the case study on the Zaalklapspruit Wetland system will be the poster child for wetlands in terms of how they can be improved, as well as how important they are in a mining-dependent economy, especially when looking to address post-mining landscapes. This is due to the myriad of advantages of these systems, including cost and long-term maintenance in relation to active technological systems that require heavy capital and operating investment, as well as long-term commitment from either government or the private sector to operate. ❑

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Following rehabilitation water now moves slower through a larger area of the wetland, rather than through a channel in the centre.

The rewetting of the wetland has resulted in the re-establishment of numerous wetland plants.

South Africa's first wetlands offset guideline nearing completion

A new best practice guideline for wetland offsets is nearing completion. Wetland offsets can potentially play an extremely important role in dealing with residual impacts of developments. Residual impacts refer to the inevitable remaining impact (even after rehabilitation) on wetlands, which each development in or near a wetland inevitably has. At present, every development which impacts on a wetland leaves the overall wetland network worse off than before, and less able to support biodiversity and deliver key ecosystem services. Wetland offsets provide a mechanism for dealing with this residual impact through the rehabilitation of other impacted wetlands, and also through protection of other high-quality wetland sites.

Industry and regulators in South Africa have recognised that, although offsets may be extremely useful in terms of compensating for residual, permanent impacts of development activities on biodiversity and ecosystem services; it is necessary to approach them with due caution and consistency, and from a strong scientific foundation. Further, they need to be applied in a way which is practical and realistic for industry to implement.

Therefore, the wetland offset guideline has been compiled by SANBI in partnership with the Department of Water Affairs, with additional support from Coaltech and the WRC through the project focusing on limiting and mitigating the impact of coal mines on wetlands.

The guidelines address the range of issues necessary to ensure that offsets are applied in a way which factors in the full range of social and environmental costs arising from the permanent loss of the ecological infrastructure, biodiversity assets and the ecosystem services affected by development activities.

The goal of wetland offsets is to achieve no net loss with respect to the following: water resources (focusing on the importance of wetlands for supporting water resource management objectives, as well as people's use and cultural values associated with wetlands); ecosystem and habitat objectives (especially in terms of meeting national and local objectives for habitat protection and avoiding worsening of ecosystem threat status); and species of special concern (particularly threatened, rare or keystone wetland species).

The guideline emphasises that wetland offsets are applied as the last stage in the mitigation hierarchy and are only aimed at mitigating or compensating for residual impacts of project development on the environment after all reasonable options for avoiding, reducing and remediating impacts have been exhausted.

The guideline also emphasises that the use of wetland offset does not change the decision-making process on whether a development should go ahead or not. Projects with unacceptably large impacts on a wetland should still not be allowed, and the use of offsets will not change the decision-making process. All offsets do is allow the residual impact of developments to be compensated for, and hence avoid the slow and inevitable degradation of the wetland system.

Once published, the guidelines will set clear standards and approaches and serve as a formal starting point for the development of sensible, practical, implementable and fair offset projects which deliver optimum benefits to industry, society and the environment in terms of dealing with residual impacts on wetlands. It is anticipated that the guidelines will be formally adopted by DWA later in the year, and will be equally applicable for regulatory processes carried out by the Department of Environmental Affairs and its provincial counterparts, under the National Environmental Management Act.