



SIBANYEAMANZI

Acid mine drainage (AMD) refers to the acidification and contamination of naturally occurring water resources by pyrite-bearing ore in underground mines and rock dumps, tailings dams and pits on the surface.

We have identified the risk of potential long-term acid mine drainage (AMD) at some of our operations. In response, Sibanye has adopted a proactive approach to mitigate this risk by initiating projects, such as SibanyeAMANZI (our long-term water management strategy), and by acquiring and developing innovative treatment technologies and regional mine closure models to predict water quality impacts.

A comprehensive water quality monitoring programme that includes biomonitoring has been compiled to allow early detection of potential AMD. AMD, if managed this way, will not develop into a material risk for Sibanye or the broader community in the Far West Rand Basin.

ACID MINE DRAINAGE HIGHLIGHTS

- Sibanye has a proactive approach to AMD
- SibanyeAMANZI, our long-term water management strategy, is integral in addressing AMD

Innovation and projects

SibanyeAMANZI

Our Water Management Department has developed an integrated dynamic water management strategy – SibanyeAMANZI – to guide the implementation of our Water Management Policy through life of mine and beyond closure.

SibanyeAMANZI, evolved from the Liquid Gold project initiated by Gold Fields in 2005, is aimed at ensuring that discharges from Sibanye's Driefontein and Kloof and Gold Fields' South Deep mines comply with water use licence requirements. The SibanyeAMANZI strategy focuses on not only reducing water use but also – as far as is feasible – on making Sibanye independent from purchasing municipal and/or Water Board water.

We have since established a water technology innovation hub at our Libanon workshops, supported by the Driefontein Assay Laboratory. The hub is equipped to simulate moving bed ion exchange, membrane purification, various forms of demineralisation, and bench scale coagulation and flocculation. This technology enables the recovery of uranium, rare earths and other valuable metals, as well as the conversion of contaminated salts into commercial commodities, such as fertilisers and explosives.

West Rand Tailings Retreatment Project

Our West Rand Tailings Retreatment Project (WRTRP) will also improve management of currently affected sensitive dolomitic aquifers and water resources. The direct result of the commissioning of a sulphuric acid plant will be a reduction in residual sulphide sulphur concentrations from historic tailings storage facilities, thereby averting the risk of AMD and mobilisation of toxic heavy metals into the environment.

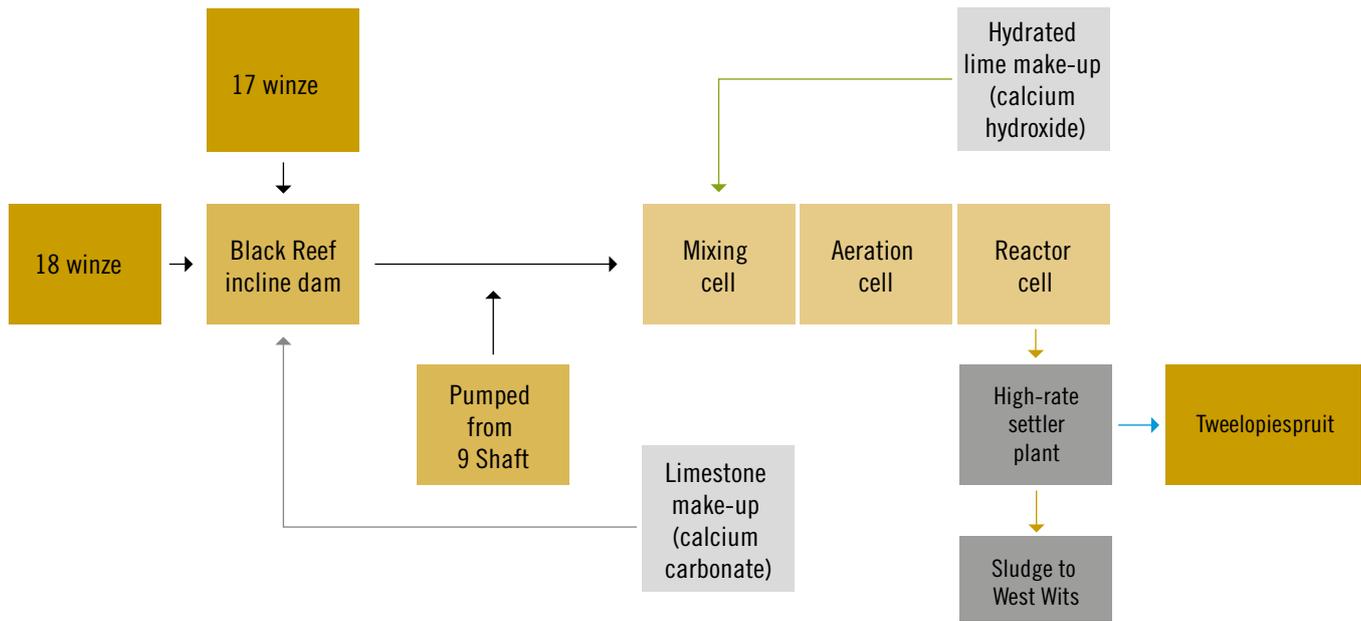
The WRTRP is an intervention with eight years of extensive metallurgical test work and design behind it. A definitive feasibility study of the WRTRP, completed in 2016, has shown significant opportunity exists to extract value from surface resources in a sustainable manner with benefits for the region. A large-scale central processing plant will be built for economical extraction of gold, uranium and sulphur from the retreatment of tailings on dams across the West Rand. The residues will be redeposited in line with modern sustainable practices on a well-managed regional tailings storage facility. Any potentially negative impacts will be managed similarly.

Ultimately, all tailings on the West Rand, even on dumps not necessarily owned by Sibanye, will be cleaned for the greater good of the environment and local communities. Construction of the first module is expected to take 33 to 36 months from mid-2016, with plant commissioning planned for 2020. First-phase production is expected to be around 1.3Moz of saleable gold and 33Mlb of saleable uranium over a life of mine of 18 years.

Water-use improvement projects

Our team focuses on several water-use improvement projects at any given time, including further process optimisation and refurbishment of the Driefontein North Shaft water-treatment plant. A 5MI/day Crystalactor, registered to Royal Haskoning, softening plant was completed at Cooke 4, and we initiated the design and construction of the 30MI/day settlers for the Trans-Caledon Tunnel Authority (TCTA) Western Basin Water Plant Upgrade Project. The purpose of this project is to improve stability of the side walls of Dump 20 and restrict AMD flowing into the environment. Test work has been conducted on metal and salt reduction from underground water using lime softening and coagulation as unit processes.

AMD TREATMENT PROCESS



SIBANYE'S WESTERN BASIN AMD TREATMENT FACILITY

During dry weather flow, up to 30MI/day of AMD can decant from the Western Basin into the Tweelopiespruit/Crocodile River system. To prevent AMD decant, the Department of Water and Sanitation appointed the Trans-Caledon Tunnel Authority (TCTA) in 2013 to contract Sibanye to treat the AMD in the Western Basin AMD treatment facility as an interim solution. Due to stability issues caused by deposition into the CPS (Cooke surface operations) pit, intervention was required to establish a well-engineered settler facility. The AMD treatment facility was upgraded to treat 30-50MI/day of AMD water. The new technology used decreases the footprint for treatment of AMD by up to ten times as compared to conventional settlers.

Water is pumped from the old 9 shaft Randfontein to the AMD treatment facility, where a system of unit processes such as neutralisation, precipitation and separation remove acidity, metals and uranium. Currently the agreed operating rules for the facility include:

- Compliance with the effluent standards prescribed in terms of the directives issued by the Department of Water and Sanitation
- Process pH ion of around 9.5
- Ensuring sufficient buffer capacity in the basin to ensure there is no spilling from the underground workings, by maintaining the basin water level at a pre-determined level below spill level at 17 and 18 winze

The sludge is co-disposed with tailings in the basin. The only chemicals used are hydrated lime and flocculants.

The current facility has capacity to treat 30MI/day, but provision was made to increase capacity to 50MI/day should the TCTA require this additional capacity. The current average cost of treatment is R5/kl, of which Sibanye contributes one third.

The facility operates under three Department of Water and Sanitation directives and a Department of Mineral Resources' environmental management plan.

In-basin disposal of reworked mine tailings has led to a significant reduction in acidity and metals, such as iron and manganese, and reduced the amount of hydrated lime needed for treatment while eliminating the use of limestone completely resulting in a substantial cost saving.



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