Mine water stewardship begins with effective water management

Nirvishee Juggath, Director of Water Management for WSP, outlines the key management principles that need to be put in place for mining companies to reduce their operational water consumption.

A considerable challenge facing the African continent is the decline of the availability of fresh water to meet basic human and ecological needs. This is putting significant pressure on industry to reduce its operational water consumption, pressure that will likely increase in the years ahead.

Looking at South Africa, for example, this pressure is already evident. A growing population and rapid urbanisation, which lead to deforestation and increased demand for water, is putting strain on the country's supply. When operational water requirements from mining and industry are included in the mix, the need for responsible water stewardship starts to become clear. It's worth noting that South Africa is classified as a semi-arid country, and that this demand on an already limited water supply contributes to a growing water shortage crisis in the country.

Considering that mining is an essential part of the national economy – according to Boston Consulting Group, it contributes about 8% of GDP and provides direct employment to approximately half a million people – it is imperative it can operate optimally. Though mining uses less than 3% of the national water supply, it is one of the country's largest industries and therefore in a position to make a powerful impact if it prioritises responsible water usage.

Accounting for the pressure to reduce

Water is a basic human need. Poor water management has far-reaching impacts on the environment and surrounding communities. On a practical business level, it also has a negative impact on a company's image and will have a deleterious effect on its environmental, social and governance (ESG) reporting.

Failing to implement effective water management and become a responsible water steward also has financial implications. Mining companies must demonstrate responsible water management to access the funds required to develop new projects and expand existing operations. Furthermore, most investors are environmentally conscious and often require that the companies they invest in share their values.

Therefore, mines must investigate and implement measures that enable them to reduce their dependence on external water sources, while still maintaining their operations for the short- and long-term.

A key component of becoming a responsible water steward is committing to effective water management. This can be broken down using the five key principles of an effective water management strategy:

1. Quantification of volumes

Having a well thought out monitoring network and a central repository for the data is the first step in effectively managing water resources, which allows for the quantification of the current water status of a mine. Flow monitoring onsite is often primarily focused on streams that a mine is required to pay for or that are linked to a regulatory requirement: a municipal water supply, river abstraction, etc.

While internal reuse, recycle and inter-transfer streams are frequently not measured – since there is no regulatory or cost implication to these – we recommend that these be included for a complete view of flow monitoring and more accurate data for better informed reporting, planning and decisioning.

2. Knowing your status

The key to an effective water management strategy is knowing your water status. Mines should keep track of trends and gain an understanding of how water is being lost from a system, where, and what volume of water is being used. These metrics can then be used to identify areas for improvements.

Water conservation and management initiatives can only be implemented if there is a clear understanding of water use. This can be accomplished by understanding the sources of water, how much water a mine consumes and exactly how this water is being consumed.

3. Modelling the site water management

With the recommended flow monitoring network established, a mine should invest in a functional and dynamic water and salt balance model. This is a key recommendation and will allow for the quantification of the inputs, outputs and storage of water within the system over a specified time period. It provides an understanding of the key hydrological processes (climate, runoff, etc), the prediction of water availability and the effective management of water resources.

A key understanding of the environment and catchment area of the mine's location is imperative to realise the risks or opportunities related to the supply-side of water management for an operation, and this can be coded into the water balance model. The salt balance will assist in quantification of the loads of relevant contaminants to assess water quality impacts as well as provide an understanding of the 'fitness-for-purpose' of the available water use.

4. Optimisation and identification of opportunities

The use of a 'fit for purpose' study can reveal opportunities to reduce water intake and offer insight into how water on a site can be more effectively reused and recycled. When our teams perform such a study, we identify all the water sources available, both in terms of quality and quantity. For example, we look at groundwater ingress into mine workings, rainfall and runoff captured in contaminated areas, water abstracted from a natural resource (river, dam) for use on the site and water recovered from tailings facilities and treatment processes. We then list all the water uses and again look at the quality required alongside any constraints in terms of water quality.

These uses are matched with the water available, taking into consideration the site layout and seasonal variations. We can then provide recommendations on where and how to reuse water on site. This process has been proven to reduce freshwater consumption and, in some cases, reduce the volume of water requiring treatment, thereby reducing treatment costs.

Another key water management approach is preventing the mixing of impacted with non-impacted water using active dewatering, clean and dirty water separation, and continuous rehabilitation. This enables sites to release cleaner water to the environment, making it available for other users in the catchment area.

5. Mine closure considerations

Finally, mines would do well to take a full lifecycle approach to water management that includes considerations related to closure and post-closure. When a mine approaches closure without having followed a water stewardship approach, there are two potential risks. The first is a significant financial risk associated with retroactive rehabilitation of mine-impacted areas. The second is delayed closure and certification as additional time is needed to implement new protocols and procedures to meet regulatory requirements and specifications for closure.

Progress at present

There are currently several water saving initiatives being implemented by local mines and from which inspiration can be drawn. For example, some mines are implementing side stream treatment processes, which enable improved reuse on mine impacted water streams. Another water saving initiative entails improving density control on tailings thickeners. With a better understanding of relevant water metrics, intake streams and reduction initiatives, along with more focus on reuse, recycling and water efficiencies, mining companies can identify specific water saving opportunities more effectively.

Whichever approach mining companies take, both mining and water share the commonality of being essential to the success and growth of the African continent. Mines are in a unique position to drive responsible water stewardship and set the precedent for other industries to adopt.

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A wastewater basin of an iron ore mine. Mining companies must demonstrate responsible water management to access the funds required to develop new projects and expand existing operations.

Elevating efficiency in mineral sands with Grindex Bravo pumps

Grindex Bravo submersible pumps were selected by a mineral sands operation on the West Coast of South Africa and, according to JD Nel, Key Account Manager at Integrated Pump Technology, these will be used across various areas on the minerals processing plant.

Nel says Grindex Bravo has previously supplied pump solutions to this operation and was called on to propose a solution for a range of pumping applications where the plant had been experiencing premature failure on competitor pumps it had installed.

He adds that the incorrect pump is often specified for an application, and that when it comes to pumping in harsh applications, such as this, it is vital that the operating parameters are assessed to ensure high levels of performance and reliability. The Integrated Pump Technology team did a complete on-site assessment at the mine before proposing an effective and cost-efficient solution that would achieve the required flow and head.

"Pumping in a mineral sands operation requires robust pumps constructed of the correct materials to deal with the abrasive nature of the material being transported. Furthermore, in all applications at the plant, the pumps are required to move fluids with high solids concentrations, which is more complex than simply pumping water," Nel says.

In the first application, 20 Grindex Bravo 600 pumps featuring a 25.5% chrome material for wet-end components will be pumping excess water overflow or spillage back into the system. These pumps offer a flow rate of 35 l/s at a head of 25 m of handling particles sizes from 8 mm all the way up to 40 mm at SGs from 1.2 to 1.6. An agitator beneath the pump intake ensures effective material suspension and transfer, making the pumps ideal for these challenging conditions.

In addition, six Grindex Bravo 200 slurry pumps were provided to the customer for pumping spillage from the thickeners. Though smaller, these pumps have the same features as the larger Bravo 600 units and will handle large particles with ease.

Several Grindex Bravo Salvador sludge pumps have also been put to work at the mineral sands plant to handle drainage.

Grindex Bravo submersible pumps have been chosen for a mineral sands operation on South Africa's West Coast.