

# Handling water



**IM looks at new technologies and ideas with industry specialist input**

**V**íctor Muñoz Saavedra, Senior Consultant - Hydrotechnical Engineering with SRK notes that “the fields of water management and hydrology have seen a shift in how data for hydrological analyses are obtained and used. Since the beginning of the satellite era in 1979, meteorological data from satellites have increasingly complemented data from ground-based sources such that now, real-time hydrological information can be accessed worldwide. Examples of these data sources are listed below.”

The US National Oceanic and Atmospheric Administration (NOAA) (source: land surface stations) databases provide access to worldwide, ground-based, meteorological information. Two important databases are the Global Surface Summary of the Day (GSOD), with more than 9,000 stations and Global Historical Climatology Network (GHCN), with in excess of 75,000 stations in more than 180 countries.

“The NOAA databases are excellent sources for historical and current meteorological data.”

He also notes the value of reanalysis tools (source: processed ground and satellite data). “Reanalysis uses a process called data assimilation to combine data from satellites, land surface stations, and numerical models to simulate the Earth’s climate. The time step for reanalysis can be as short as three hours and can be applied to data collected since 1979. Two examples of reanalysis tools are Modern-Era

Retrospective Analysis for Research and Applications (MERRA) from NASA and ERA-Interim from the European Centre for Medium-Range Weather Forecasts (ECMWF). MERRA and ERA-Interim encompass more than 100 meteorological parameters, including total precipitation, rainfall, snowfall, wind speed, air temperature, and relative humidity. ERA-20C, also from the ECMWF, comprises daily meteorological information from 1900 to 2010.

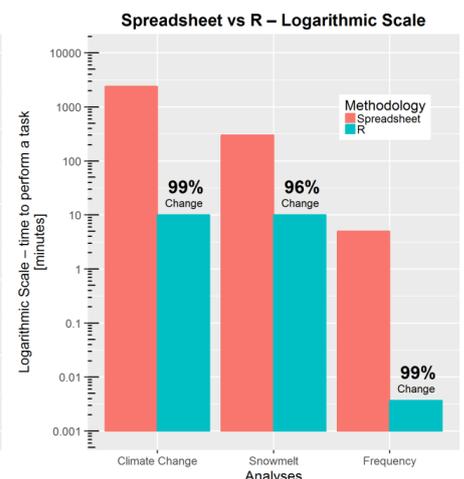
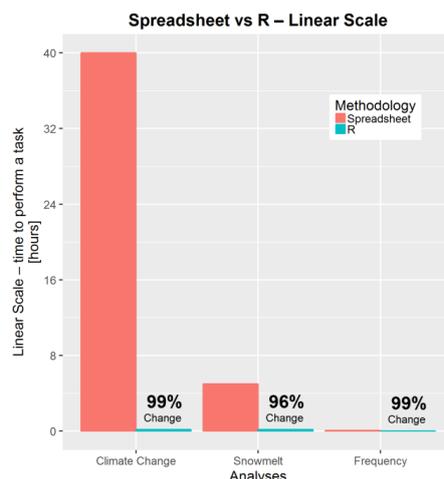
“Reanalysis tools and NOAA data are publicly available worldwide. They can also be combined with local meteorological information to establish and compare historical and current patterns for a given area.

“Global climate change models (source: climatic models) and scenarios are presented by

*In South Africa, the innovative SlurrySucker dredge unit is capable of extracting high tonnages of silt and built-up sediments at a fraction of the money required to shut down downstream and upstream processes*

member meteorological institutes in the Intergovernmental Panel on Climate Change through a variety of assessment reports. Each model and scenario presents projections for the entire planet up to the year 2100 for one meteorological parameter. The combination of climate models and scenarios can produce hundreds of projections for a given location on Earth. This variation among projections can be incorporated into long-term climate predictions for a given area.

“Each of the above mentioned meteorological



sources provide an understanding of climatic parameters in a given area on the planet, including mean annual precipitation, monthly precipitation distributions maximum snowmelt rates, maximum and average annual temperatures, monthly and annual pan/lake evaporation, rainfall intensity-duration-frequency curves, peak flows for different return periods, etc.”

The sources Saavedra mentions can produce large volumes of data, which can be tedious and time-consuming to compile and process using standard spreadsheets. “Therefore, the scope of hydrological analyses can extend beyond conventional consultancy work. Fortunately, script-based programming tools are available that can reduce processing time to a matter of seconds.

“An example is the statistical and graphical language *R*. *R* is an open-source, free software environment that was released in 1993. It has since become the standard problem-solving tool for a growing body of researchers from industry, government, and academia who work with large quantities of data. Statistical methods and other functionalities can be modified by users; therefore, *R* is always up-to-date. *R* has built-in access to public information from government institutions, including the US Geological Survey, NOAA, and Google or Bing API.

“*R* facilitates data access, compilation, and analysis using simple scripts that can be reused

for each new project, improving regional results for hydrologic studies. In addition, the time required to perform typical hydrological analyses is greatly reduced, as shown in the figure below which compares standard spreadsheets and *R* on both a linear and logarithmic scale. This reduction in time can be invested in broader and deeper analyses of meteorological parameters, bringing to the consultancy environment more definitive results for worldwide meteorological estimations.

“The amount of data available for hydrological analyses has increased drastically, thanks to vast, easily accessible, public databases and data management tools. It is time to progress beyond traditional tools such as spreadsheets that have kept us in an ‘inertial comfort zone’. These databases and tools can heal the gap between consultancy and academia—marrying simplicity and innovation—thereby helping to improve our understanding of the global environment.”

## Delivering water

Xylem has enhanced its popular Flygt 2000 drainage pump range. It says, “the new and improved Flygt pumps will offer customers an even more reliable and robust selection of large and mid-sized drainage pumps engineered for the most challenging dewatering conditions and applications.”

The new 25 kW Flygt 2190 mid-sized

*The Flygt 2400 stainless steel drainage pump is designed to provide excellent wear-resistance for reliable and efficient dewatering in this demanding dewatering*



submersible dewatering pump is built to handle tough, abrasives-laden liquids. It

is available with two impeller options: the signature ‘Dura-Spin’ safeguards against wear by sweeping abrasive particles away from the impeller neck while the semi-open impeller increases uptime by preventing fibrous solids from obstructing the pump. The pump’s conical trim sleeve, a quick and easy to use impeller-adjustment feature, restores clearances to near-original condition boosting pump performance, while robust cable entry ensures safe, continuous operation. The new and improved Flygt 2201 shares the same proven technology as the Flygt 2190, in addition to providing customers with a super-high head alternative

with its two-stage hydraulics version.

Xylem's Flygt 2400 stainless steel pump, the first stainless steel-only pump in the Flygt 2400 series, provides customers in the mining sector with a durable, super-high head pump suitable for transporting chemically-aggressive mine water. Target ores such as gold, silver and copper are often sulphidic and, when exposed to water and air, could react to form sulphuric acid.

BBA Pumps' recently launched dewatering units line-up consists of new 4", 8", 12" and 20" pump units. The main focus was on reduction of the carbon footprint. BBA says "all units are standardised on the cleanest highly regulated diesel engines to comply to stringent European emission legislations.

The 4" unit: BA100K D193 delivers up to 190 m<sup>3</sup>/h and a maximum head of 22 m. The company says it is the "first single-cylinder pumpset with DPF/DOC aftertreatment technology." Delivering low fuel consumption, "the BA100K can pump 110 m<sup>3</sup> water per litre of fuel. It also offers DriveOn<sup>®</sup> technology for 1,500 hours extended service interval and 25% savings on oil and solids handling up to 82 mm for dewatering conditions.

The 8" unit: BA180E D315 delivers up to 720 m<sup>3</sup>/h and a maximum head of 41 m, powered by a new four-cylinder Perkins engine with DPF/DOC aftertreatment technology. The company says it is "super silent and lightweight canopy with small outside dimensions.

The 12" unit: BA300E D328 delivers up to 1,250 m<sup>3</sup>/h and a maximum head of 19 m, also powered by a new four-cylinder Perkins engine with DPF/DOC aftertreatment technology.

The 20" unit: BA-C500S11 D711 delivers up to 5,500 m<sup>3</sup>/h and a maximum head of 37 m, featuring the "cleanest diesel engine in its class – Volvo Penta TAD1374VE with AdBlue aftertreatment. Pump efficiency is up to 85%, excellent NPSHr curve."

## Optimise water storage

Sediment in process ponds and reservoirs is a serious concern. In South Africa, Lee Vine, Managing Director of Integrated Pump Rental, a Grindex dealer, says severely silted up process water dams and ponds negatively impact the water storage capacities on a plant or mine, and affect all downstream processes.

"Use of water resources need to be optimised and a greater focus must be directed to desilting water storage facilities. We have started to see this happening and there is an increased interest from the market for our SlurrySucker," he says.



*The BA180E delivers up to 720 m<sup>3</sup>/h and a maximum head of 41 m*

Launched less than 12 months ago, the innovative SlurrySucker dredge unit is capable of extracting high tonnages of silt and built-up sediments at a fraction of the money required to shut down downstream and upstream processes to clean out these types of water storage facilities. It is simple to use and two standard units are available. The SlurrySucker Mini is capable of extracting 120 m<sup>3</sup>/h of slurry/water mixture, equating to 30 to 40 t/h (dry), while the larger SlurrySucker Maxi will remove between 70 to 80 t/y (dry). The Mini has a 100 mm discharge and the Maxi a 150 mm discharge.

SlurrySuckers are manufactured using locally produced components and incorporate pumps from the Grindex slurry and dewatering range. During the development of this innovative dredging system use was made of computational fluid dynamics (CFD) to optimise and validate the design.

Engineered as robust, compact dredging units, SlurrySuckers can be easily transported on a standard road trailer, making it simple to move from pond to pond on a mine site. The units are engineered to be operated by a single person.

Vine says that Integrated Pump Rental has the necessary technical skill to ensure that the pump selection matches the dredging operation requirement, and it could include either Grindex dewatering pumps where agitation of the slurry is required, or Grindex slurry pumps where there is a need to remove slurry from ponds or dams.

Another very significant advantage is that the SlurrySucker can be used on plastic lined dams without any damage to liners. This is very important from an environmental perspective as there is no risk of the liner being cut and water leaking out.

## Reducing pump wear

Last year, in a Latin American copper tailings application, a GIW LSA centrifugal slurry pump with Enduraclad suction liner increased wear life from 450 hours to 2,000. The GIW solution quadrupled pump wear life and created dramatic savings for the mine's tailings pumping operations.

The company had struggled for years to reduce maintenance downtime in its tailings operations. The tailings —very fine particles that are highly abrasive in slurry — was wearing out pumps more quickly than other equipment in the tailings line, increasing the frequency of downtime. Ronnie Willis, Senior Product Manager — New Materials at GIW, says, "They were having such severe wear that they were repairing the tailings pumps every 400 to 450 hours."

When considering replacement parts, manpower, and revenue lost due to downtime, the costs the mine was facing on a regular basis were staggering. It desperately needed a solution for more efficient operations.

An LSA centrifugal slurry pump was installed in a tailings booster application where GIW's exclusive Enduraclad™ material was applied to the new suction liner. "With the application of this new material," Willis says, "they've been able to extend wear life up to 2,000 hours and also improved wear life of other related pump parts."

When Enduraclad made its debut in 2009, its uses were limited. It was only applied to suction liners and increased wear life up to three times. But since then, its capabilities have expanded to allow coating on other essential parts and enables it to provide even greater longevity for GIW pumps.

"Although Enduraclad-bonded parts are more expensive, they are well worth the price. They will cost more than uncoated parts, such as suction liners," says Willis. "However, you are saving on costs by using fewer parts, reducing maintenance costs, and not suffering the downtime revenue loss. To remove and replace the parts on one of these pumps requires two to four people working with tools and lifting devices for six to eight hours. So the longer you can keep the pump running with nobody touching it, the more operational costs you save."

Willis explains: "We're not just developing these really specialised materials and processes and charging higher prices. We're continually looking for ways to reduce the cost of materials so we have a product that serves customers' needs and fits their budgets."

GIW says its metallurgical experts are already testing new cladding materials that will last even longer than current ones, "and there may be even greater improvements in the future with enhanced Enduraclad material."

## Water treatment

Considering improved mining efficiency through water treatment and reuse, Karen Dobson, Mining Global Business Leader, Dow Energy & Water Solutions and Matheus Paschoalino, Latin America Customer Application Specialist, Dow Microbial Control explain that “comprehensive mine water operations can be categorised into three strategies -- water treatment, asset protection, and operations optimisation.”

Water treatment technologies, including filtration, reverse osmosis (RO), and ion exchange, can be used to process mine water from some of the most challenging sources and can help reduce net consumption and treat wastewater for reuse. “The application of microbial control and antiscalants on assets like equipment and pipelines can help reduce downtime, lower maintenance and add longevity to these assets. These efforts can directly address the sustainability compliance and efficiency challenges facing mining operations today.”

Modern water treatment strategies depend on several factors including the type of ore being mined, the chemicals used in ore treatment, the climate, the life stage of the mine, and the environmental management practices in place. Ion exchange, RO, nanofiltration, and ultrafiltration (UF) are core technologies to purify and recover water to directly address increasing

pressures from environmental regulations and to help operators deliver on their sustainability goals.

“For example, a coal mine in South Africa turned to Dow UF technology as a pretreatment to RO when conventional sand filters were found ineffective for treating wastewater for reuse. Dow’s UF and RO technologies help treat the wastewater for operational reuse, helping reduce overall costs and helping to avoid negative impact to nearby at-risk water sources. Dow UF technology and Dow FILMTEC™ RO elements reject particles, colloids, suspended solids, oxidised Fe/Mn and microorganisms from the wastewater, which is then transported to a nearby power station, where it is demineralised with Dow ion exchange resin technology and used as boiler feed makeup water. These technologies help provide higher and more consistent filtrate quality, increased feed and turbidity tolerance, lower silt load and less frequent clean in place (CIP), directly lowering chemical use and extending the life of the RO



*In a dewatering application Kroomdrai mine in Witbank, Mpumalanga, South Africa suffered large-scale flooding of one section of the coal mine causing lost production. Pioneer Pump in conjunction with its local dealer, mobilised a 150CH pumpset complete with John Deere 6125 engine to be used in dewatering the section. The pumpset operated continuously for seven days and removed over 54,000 m<sup>3</sup> of water from the mine without stopping and enabled the mine to get back to work quickly to the satisfaction of the mine and workers involved*



membranes. This highly automated operation was found to lower maintenance and reduce the mine's water footprint.

“Pipes are susceptible to degradation from scale buildup as a result of mineral precipitate that forms as water flows. In mineral processing operations in particular, pipes and equipment are susceptible to the insoluble salts—calcium carbonate, calcium sulphate, magnesium and silicate—that drop out of process water and solutions. These salts build up on equipment and pipes to create scale, which can restrict pipe flow and ultimately require downtime for cleaning. Antiscalting technologies can address both organic and inorganic flow assurance challenges—including prevention of build-up before it occurs and removing build-up when it does occur. Inhibitors and dispersants help prevent scale from forming, while chelating agents remove and inhibit scale deposits.

“In addition to scale build-up, microorganisms can grow just about anywhere water can be found. The resulting biofilm formation can then cause pipe and equipment corrosion due to microbiological induced corrosion (MIC), leading to leaks and impacting the flow of water. While microbial contamination is known to cause MIC in typical transmission pipelines of water and/or mineral slurries, most mining companies are unaware of how microbiological contamination hinders operational efficiency, including product quality losses due to bacteria metabolites and impacts on mineral separation. It's important that a microbial control program perform its job effectively, while doing no harm to people or the planet, and then ultimately go away - providing extended microbial control while resulting in minimal negative impact on the environment. Dow Microbial Control is able to carry out advanced field diagnostics, which identify contamination hot spots in a mining plant and recommend customised solutions using our Dow AQUICAR™ Water Treatment Microbiocides portfolio, which can provide quick kill action as well as long term protection tailored to the decontamination needs of the process.”

In summary, maintaining pipe and equipment integrity through microbial control and antiscalants reduces drag and pump energy consumption while improving flow and corrosion management.

“With the Power of **ORE** (Operational Efficiency, Recovery Enhancement, Environmental Compliance), Dow brings a wide range of products and expertise to address a broad spectrum of mining, mineral processing and remediation challenges. Through integrated solutions, Dow can help deliver the right water quality to facilitate a reliable water supply while helping to maintain clear, efficient pipelines. By using filtration, ion exchange, and reverse osmosis technologies that can process even the most challenging mine water, integrating membrane installations that treat wastewater for reuse, and applying antiscalants and biocides that can help reduce downtime and add longevity to assets, a comprehensive water management program can increase mine efficiency and wastewater reuse, while decreasing downtime for cleaning and maintenance.” **IM**