

Cost-effective capacity upgrade

Maryke Foulds speaks to Headstream's commercial director Julian Moore.

H **EADSTREAM** **HAS** recently commissioned its third plant in South Africa, which is a HYBACS retrofit to upgrade the Hartbeesfontein WWTW.

"While we are extremely proud of our first two plants, these were greenfield new builds and not an upgrade to an existing plant. The Hartbeesfontein project is the upgrade of an existing plant to double treatment capacity from 4 M³/d to 8 M³/d while also improving

treatment performance to enable it to meet nutrient discharge standards," explains Moore.

"This is very exciting as it demonstrates that the HYBACS process is ideally suited for upgrading conventional activated sludge plants to increase treatment capacity and improve performance. Upgrading existing treatment infrastructure is extremely important in South Africa and it is in this scenario that HYBACS is significantly more competitive than alternative technologies."

In simple terms, the HYBACS process is a hybrid BNR activated sludge process where a fixed biomass process is combined with a conventional suspended biomass activated sludge process followed by conventional secondary settlement via a clarifier. It thus lends itself as an ideal retrofit technology for the widely used conventional activated sludge process.

The fixed biomass reactor, which is called a SMART unit and is unique to the HYBACS process, contains a very high concentration of attached

Cost Effective Upgrade to Increase Treatment Capacity, Improve Performance and Reduce Energy Consumption

Hartbeesfontein WWTW - Upgrade from 4M³/d to 8M³/d



Tubli WWTW - Upgrade from 40M³/d to 100M³/d



2 recent HYBACS upgrades demonstrate its cost effectiveness and ease of implementation:

Hartbeesfontein WWTW: HYBACS upgrade to provide BNR and increase in treatment capacity from 4M³/d to 8M³/d:

- 100% increase in treatment capacity
- 8 SMART units installed
- No Civil Works to increase aeration tank volume
- 40% saving in kWh per M³/d (installed power)

Tubli WWTW (Bahrain): HYBACS upgrade to increase treatment capacity from 40M³/d to 100M³/d:

- 150% increase in treatment capacity
- 42 SMART units installed
- No Civil Works to increase aeration tank volume
- 40% saving in kWh per M³/d
- R3,6 million cost per M³/d increase
- Excellent Effluent Quality:
 - <0,3mg/l Ammonia
 - <10mg/l TN
 - <30mg/l COD
 - <15mg/l TSS

HYBACS is supplied in South Africa by
Headstream Water Holdings (Pty) Ltd
www.headstreamwater.co.za
info@headstreamwater.co.za
t 011 886 7805

biomass and also delivers an oxygen transfer rate significantly higher than that achieved in the suspended biomass reactors. Therefore the SMART units are able to remove a high portion of the incoming COD in a very efficient manner, which when combined with the existing suspended biomass activated sludge reactors enables the plant to deal with a significantly increased load.

"The HYBACS process was initially developed in South Korea in order to address the key challenges they faced due to rapid urbanisation and industrial development around existing plant sites. Thus a significant increase in treatment capacity and an improvement in effluent quality were needed, but there was no space in which to expand plants. The key drivers for the development of the HYBACS process was that it needed to retrofit onto existing activated sludge plants and it needed to be able to significantly increase treatment capacity and improve effluent quality within the current plant footprint," explains Moore. "Additional drivers were cost effectiveness, energy efficiency and the removal of odour, particularly important given that high-density accommodation surrounded many of the plant sites in the cities."

The Hartbeesfontein upgrade was urgently required due to the increased flow into the existing plant combined with the higher loading on the plant from a local abattoir. The upgrade to double treatment capacity to 8 M ℓ /d is being achieved with a HYBACS design that involves the installation of eight SMART units upstream of the existing suspended biomass activated sludge reactors. Additional modifications to the plant infrastructure include:

- the conversion of the primary settling tanks to anaerobic tanks for enhanced biological phosphate removal
- increasing oxygenation capacity in the aerobic reactor with an fine bubble diffused air (FBDA) system
- the construction of a new clarifier.

"As no increase in the volume of the aeration reactor was required, the HYBACS process provided a significant saving for the municipality with respect to reduced civil construction costs. In addition, the energy savings that the HYBACS process will deliver,

which we estimate to be up to 40% when compared to a conventional 8 M ℓ /d plant, will significantly reduce the ongoing electricity costs for the municipality."

The plant is currently in its initial commissioning phase with the first six SMART units already installed and operational. The remaining two SMART units will be installed in a second phase in the coming months to take the treatment capacity to 8 M ℓ /d.

Another recently completed upgrade project is the upgrade of the Tubli WWTW in the Kingdom of Bahrain completed by Bluewater Bio, the owners of the HYBACS technology. This HYBACS upgrade comprises the conversion of two of the existing

of the HYBACS upgrade section of the plant is 40% lower per megalitre treated than the rest of the plant and one can really appreciate the overall life cycle cost savings delivered," explains Moore.

Results at the HYBACS Tubli WWTW since commissioning have been exceptional, despite the plant receiving a higher influent loading than designed for, with the effluent quality consistently exceeding the effluent standard set: <0.3 mg/ ℓ per litre of ammonia; <10 mg/ ℓ TN; <30 mg/ ℓ COD; and <15 mg/ ℓ TSS. In addition, results show a significant improvement in sludge settleability with sludge from the HYBACS upgraded portion of the plant flocculating rap-

The SMART units at Hartbeesfontein WWTW



10 aeration lanes and four of the existing 12 clarifiers into a HYBACS plant by installing 42 SMART units upstream of the aeration lanes. The upgraded HYBACS plant treats 100 M ℓ /d meaning that the two aeration lanes, originally designed for 40 M ℓ /d, now have a 150% uplift in capacity.

"No additional civil construction was required to increase the volume of the aeration lanes and the entire upgrade was achieved within the current plant footprint. The cost of the upgrade was US\$20 million (R220 million) of investment for an increase in treatment capacity of 60 M ℓ /day. That equates to just over R3.6 million per additional M ℓ /day of treatment capacity which demonstrates the exceptional cost effectiveness of HYBACS in an upgrade scenario. Add to that the fact that the electricity consumption

and settling 40 times faster than the rest of the plant while operating at a MLSS 3822 mg/ ℓ and achieving a SVI 42.9 ml/g. "This is a very significant development for us as it demonstrates the excellent performance of HYBACS on a large scale as the Tubli WWTW is a large plant treating 100 M ℓ /day. The next phase planned is to upgrade the next 40 M ℓ /day of the conventional plant to 100 M ℓ /d so that the total HYBACS portion of the plant is expanded to 200M ℓ /day.

"We are confident that when professionals in the industry see these results and the cost efficiencies that are achievable then they will be willing to embrace an innovative solution and recommend the HYBACS process to their clients, particularly in an upgrade scenario, so they can save their clients both capex and opex costs." **3S**