Wetlands turn wastewater into an asset

County Fair has invested in an environmentally-friendly water purification facility to treat wastewater generated by a poultry plant in the Western Cape. **Robyn Joubert** reports.

County Fair's poultry abattoir and processing plant in agter Paarl processes 1,3 million chickens a week, in the course of which 180m³ water/hour or 22 000m³/week becomes contaminated with blood, feathers and fats.

This wastewater cannot be discharged into rivers or used for irrigation unless it complies with discharge standards set by the Department of Water Affairs (DWA). To pull its wastewater into line with water regulations, County Fair recently invested in a pond and wetland system of five dams and 24 wetland reed beds to purify wastewater.

"In processing, it is no longer just the product that counts, but how you deal with the waste. Compliance with legislative requirements in this regard is non-negotiable and is a top priority for the Astral group," says County Fair chief operating officer Gerrit Visser.

Solids are removed prior to the water entering the integrated pond and wetland facility. These solids are processed, sterilised and sold to animal feed manufacturers as feather and blood meal. The water then passes through a series of dams and reed beds. After the water has reached irrigation standards it is used to irrigate the grounds surrounding the factory. This includes, instant turf and pastures for a herd of beef cattle. It is also used to clean the factory surrounds.

The system has been operational for only six months and is still in the commissioning process. Already, the chemical oxygen demand (COD - which reflects the degree of organic matter pollution in water), has been reduced from 4 000mg/ℓ in the raw wastewater down to less than 75mg/ℓ in the final wetland outflow.

ABOVE RIGHT: County Fair chief operating officer Gerrit Visser (right) and County Fair primary processing executive Oswald Midgley.

BELOW: Floating aerators in the oxidation pond allow oxygen to dissolve by forcing small air bubbles into the water. Stirring action keeps the microbial biomass in suspension.

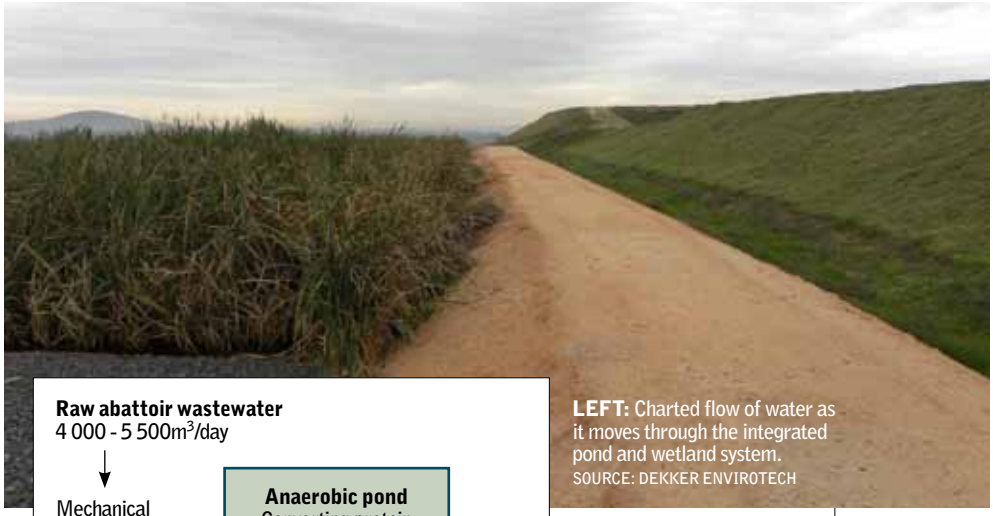
PHOTOS: ROBYN JOUBERT

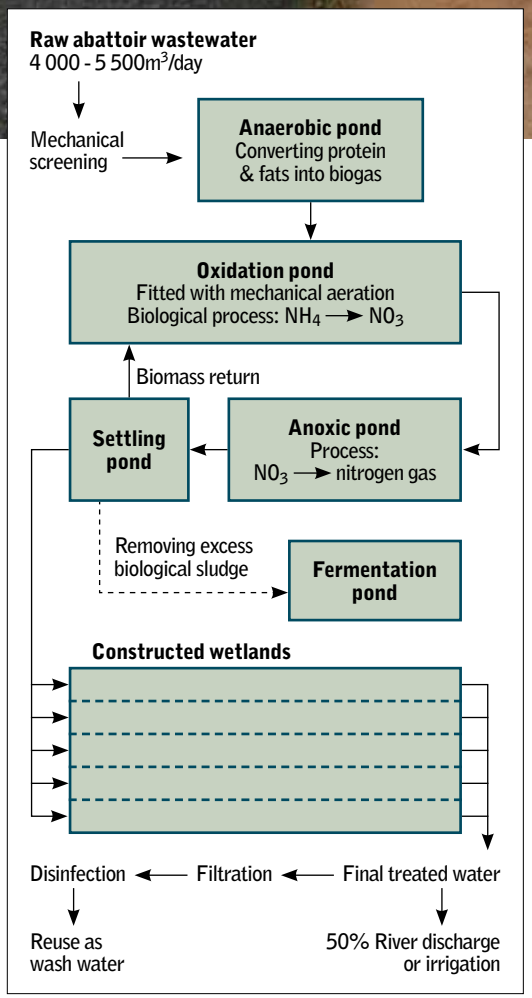
The pond and wetland system was designed by South African water treatment specialist Dr Len Dekker, who heads up Dekker Envirotech. "Freshwater resources are under huge pressure in South Africa," says Len. "Food processors cannot afford the risk of interrupted water supply because of dependence on potable water for cleaning and processing various foods, especially in the meat and canning industries. Therefore, the focus is shifting towards partial reuse of treated wastewaters. Many companies now regard their wastewater as an asset rather than a disposal problem."

Added to this, the age-old practice of uncontrolled irrigation disposal is not a viable option anymore. "Food processing wastewater often contains high levels of dissolved nutrients such as nitrogen and phosphate which causes eutrophication in downstream rivers and dams," says Len.

INTEGRATED POND AND WETLAND SYSTEM

The first step in County Fair's pond and wetland system is the mechanical





LEFT: Charted flow of water as it moves through the integrated pond and wetland system.
SOURCE: DEKKER ENVIROTECH

ABOVE FROM TOP: Water flows from the settling pond (on the right) into the constructed wetland system below.

The wetland is planted with indigenous cattails, harvested from nearby farm dams.

In the final stage, water flows out of the wetland and through a gravel bed. The final overflow can be seen in the steel chamber located in the gravel bed.

screening of the raw wastewater to remove large particles. The screening is augmented with micro-organisms which assist in digestion of fat, oil and grease.

The screened wastewater is channelled to the primary anaerobic pond, which converts organic pollutants into biogas through a passive anaerobic microbial process. "The anaerobic pond dramatically reduces the need for mechanical aeration in the oxidation pond as it removes 90% of the organic load," explains Len.

In the oxidation pond, (step 2) nitrifying bacteria convert ammonia into nitrate. Overflow water from the oxidation pond will contain trace levels of ammonia, low COD and elevated nitrate-nitrogen with secondary bacterial biomass, known as biological sludge.

In the anoxic pond (step 3) bacteria use the oxygen from the dissolved nitrate in a biological process known as denitrification. "This is a very rapid process for converting nitrates into harmless nitrogen gas that escapes into the atmosphere," says Len.

The purpose of the fourth pond, the settling pond, is to clarify the water and reduce the suspended solids. "The high suspended solids load is due to the suspended bacterial biomass still present in the water from the previous anoxic pond process. The settling pond is designed using well-known settling characteristics for

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BIO MONITOR

Tomatoes losing their taste?

WYNAND VAN DER WALT

There is a strong perception that old varieties of tomatoes that were allowed to ripen in the field were tastier than modern tomatoes. Recent genetic studies now confirm that this perceptionis at least partly true.

Old varieties tended to ripen unevenly and fruit did not have uniform size, colour or shape. Modern markets favour uniformity and appealing appearance plus good taste. This also benefits producers who can harvest crops by hand or mechanically instead of more expensive staggered harvesting as the fruit ripens, apart from losses caused by transport and handling damage and shorter shelf life of ripe fruit. Thus, most perishable vegetables and fruit are harvested well before they are fully ripe.

Researchers found that tomatoes lose taste because the ripening process has been altered from field conditions to indoor storage and retailing. Plant cells contain chloroplasts which capture sunlight energy and convert CO_2 and water into chemical energy stored in the form of sugars that form the building blocks for starch and other carbohydrates. Recent deciphering of the tomato genetic code led to the discovery of gene SIGLK2 which controls activation of genes responsible for chloroplast formation. Tests revealed that 16 modern varieties had a mutation in this gene and contained fewer and smaller chloroplasts. By replacing the mutated gene with the normal one, sugar content can be raised by 40%. Plant breeders can apply this to improve modern tomatoes. Interrupted ripening should not be confused with long-life tomatoes that have delayed softening of cell walls. – *Wynand van der Walt, wynandjvdw@telkomsa.net*

- *Source: Science, July 2012*
- *Email Wynand van der Walt at farmersweekly@caxton.co.za with 'Biomonitor' in the subject line.* ■FW

ABOVE: County Fair's plant near Paarl processes 1,3 million chickens every week. AERIAL IMAGE

← separating biological sludge, thereby leaving the water relatively clear and ready for final biological polishing," says Len.

The fermentation pond receives the sludge from the settling pond and mineralises the biological sludge.

The water then enters the constructed wetland system where plants act as a biological filter absorbing nutrients from the wastewater. Indigenous cattails were harvested from nearby farm dams for wetland reed beds because they are well suited to the local climate.

The inflow of water is controlled so that there is equal distribution between the wetland cells. The cells are positioned perpendicular to the prevailing winds to limit wave action on surface water.

"The created wetland mimics a natural wetland system where the water surface remains above the plant rooting medium, in this case the soil. Water moves slowly through the plant leaves and stems which act as a passive biofilter, absorbing and digesting the suspended particles.

The wetland also attracts a variety of bird species and enhances the overall aesthetic appearance of County Fair's grounds," says Len.

Water that has been filtered through the wetland, is compliant with Water Affairs guidelines,will be used for general wash water and not for direct re-use at the abattoir processing facility. "This would require conventional sand filtration to remove plant and insect debris; and disinfection preferably with chlorine dioxide to deactivate poultry pathogens," says Len.

Responsible wastewater treatment and re-use helps to conserve our water resources and improves relations between industries like Astral and the communities in which they operate. The estimated re-use potential at County Fair is 20% to 40% of the total wastewater volume, which will result in substantial water savings.

"In the future, energy efficiency can be added to the list of benefits. The primary anaerobic pond releases methane with a daily energy equivalent of 4t of coal. This unit can be retro-fitted with a floating cover to capture the biogas and use it as an energy source, perhaps for boiler gas heating or electricity generation at the abattoir, representing a substantial energy and cost saving," says Len.

'IN PROCESSING, IT IS NO LONGER JUST THE PRODUCT THAT COUNTS, BUT HOW YOU DEAL WITH THE WASTE.'

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Less chemicals same yields

Integrated pest management assesses insect damage before spraying crops.

Grain growers can get away with one less insecticide spray during the growing season without sacrificing yields, an Australian research project has found.

The national project funded by the Grains Research and Development Corporation looked at developing and promoting integrated pest management (IPM) for grain crops.

IPM principles involve assessing insect damage on emerging plants before spraying, rather than relying on pre-emergent insurance sprays, and applying softer insecticide sprays only when needed.

A project leader, entomologist Laura Fagan, says on-farm field trials showed that monitoring – a key IPM component – could reduce the need for conventional chemical sprays without affecting yield.

"Most of the farmers involved realised they could get the same outcome with one less spray in the season," she says.

"For canola, in post drought years, or in years with above average rainfall and low pest pressure, it is best not to apply pesticides.

"Applying less chemical to wheat appears to be the best practice as similar yields can be achieved without the extra cost of applying chemicals."

National project leader Darryl Hardie, senior entomologist at the Western Australian Department of Agriculture says the project is still working to find a conclusive answer as to whether IPM is the best insect pest management approach in Australian farm systems.

"The project showed that, after a rotation of pasture, canola, then wheat, the IPM approach was equally or more effective than the 'farmer approach' with respect to grain yield," he said. FW