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# Plumbing

Conveyance of water and waste

## AFRICA

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# Bespoke water treatment system for Old Mutual Wealth

*The Estuaries Plaza has installed a bespoke waste water treatment and purification system, which is self-sufficient and enables a virtually water neutral facility to operate.*

**By** Ilana Koegelenberg, with input from Sutherland Engineers

The Estuaries Plaza building in Century City, Cape Town, consists of three floors of general offices and one level of basement parking. The total usable area is 3 173m<sup>2</sup>. Each office floor is served by a set of male and female restrooms as well as a small kitchenette area. The basement parking also contains a security office with small kitchenette and restroom area. Restrooms and kitchens have local hot water geysers. All drainage water is collected at the basement level.

A waste water treatment and purification system (WWTPS) has been installed at the plaza. This system uses recycled waste water from the building as well as make-up recycled water from the local municipality waste water treatment plant at Potsdam and purifies it to a potable standard. This water is then reticulated throughout the building using copper piping. Primary purification occurs through reverse osmosis filtration and is supported by organic filtration and treatment processes.

All water usage is monitored by electronic water meters. The purification plant and water meters are linked to a GSM-controller for real time control, as well as monitoring and recording of the building water usage.

Potable water consumption has been reduced by approximately 88.5% against the Predicted Potable Water Rating Benchmark.

## WASTE WATER TREATMENT AND PURIFICATION SYSTEM

The WWTPS was installed at basement level. Waste water from the building is directed to this system, which purifies the water to potable level and recirculates it for reuse in the building. The complete water purification process comprises three primary components: a bio-digester, an organic media trickle filter (also referred to as a SOG filter), and a reverse osmosis (RO) plant.

Black water and grey water drainage from the building is diverted to four bio-digester tanks located in the basement. The drainage is broken down into methane gas and treated water. The methane gas is extracted for use with a gas cooking stove.

The treated water is then directed through a SOG filter. The SOG filter uses organic peat to filter the treated water organically. The SOG filter treated water is pumped into a RO process. Pre-filtration at 100 micron, 20 micron, and finally five micron occurs. The treated water is then pumped through a membrane filter by use of a high-pressure pump and diverted by a buffer tank. This purified potable water is available for reuse in the building.

In addition to the purified potable water, the RO discharges a nutrient-rich brine discharge. This mass flow loss is recuperated by the use of recycled water from the local municipality waste water treatment plant

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1. RO plant pre-filtration and dosing pumps.
2. Booster pump set.
3. Cartridge filters.
4. Bio-digester tanks in the basement.

at Potsdam. This non-potable irrigation water, referred to as Potsdam, is recycled water that is freely available within the Century City precinct and commonly used for irrigation purposes.

Buffer tanks are placed between each of the filtration processes, with the interconnecting pumps managed by a control system. The entirety of the plant is connected to a generator standby power, assuring the system is available for use in the event of a power failure.

In this manner, the Estuaries Plaza building uses approximately zero potable water from the municipal supply under normal design building demand, and the overall discharge to the municipal sewer is drastically reduced.

#### WATER PURIFICATION SYSTEM COMPONENTS

##### a) Black- and grey water treatment bio-digesters

Gravity fed by the building's black- and grey water drainage system, bio-digesters anaerobically digest the drainage water, producing methane gas and treated water. The methane gas is directed to the basement security room for cooking use. Treated water is then gravity fed to a storage tank before further treatment.

The bio-digesters were recently removed from the system though, even though the system operated successfully. This was mainly because the outflow from the bio-digesters was placing too much of a strain on the RO membranes, and the cost of cleaning and replacing them could not be justified. The system still does not use any

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municipal water — everything comes from the Potsdam supply, so the building is still off the municipal grid.

#### b) Organic SOG trickle filter

The outflow from the bio-digester system is fed to a SOG or trickling type organic filter, before being pumped to a feed tank. This SOG filter is physically comprised of peat-filled stacked crates within a bund, and makes use of earthworms, fungi, and bacteria to treat the bio-digester treated sewage water further. By spreading the type of organism activity, a larger range of variable flow and load is possible. Organisms live in the various zones, performing selective functions, which includes dissolved organic material degradation (COD reduction), conversion of ammonia to nitrate (nitrification), and removal of nitrate (denitrification).

#### c) Reverse osmosis water purification plant

The outflow from the SOG filter is pumped into the RO plant, which filters the liquid down to levels better than nanofiltration would. The level of purification is so high that the water has to be re-mineralised after purification to make it suitable for human consumption. The water is then pumped through a reverse osmosis membrane using a high-pressure filter. The resulting purified water

has a conductivity of less than 30 microsiemens and is pumped to roof level for reuse.

#### d) Remote monitoring, feedback, and metering system

Water meters are installed on the municipal and Potsdam water supply lines as well as the complete building and security office. These water meters are connected to the Airdrive remote monitoring system for real time monitoring and recording of the complete water usage of the building via the internet. A control system is also in place, which detects the water levels within various holding tanks to ensure correct plant operation and provides SMS feedback and control.

In the event of plant failure, or insufficient RO output / high building demand, the system will automatically and temporarily switch to municipal water. The water quality output of the RO plant is also monitored before being transferred to the building. This system is also connected to the Airdrive remote monitoring system.

#### DESIGN CONDITIONS

Based on the building gross floor area and SANS 10252-1, the expected daily potable water

1. *Trickling type organic filter, or SOG filter.*
2. *Backflow preventer.*
3. *RO plant pre-filtration and dosing pumps.*
4. *Reverse osmosis plant.*

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High pressure pump and control panel.

usage of the building is 3 188ℓ, and this is used as the design condition for the WWTPS. A complementary calculation by the environmental consultant, Terramanzi Group, based on the installed fixtures and usable area of 3 173m<sup>2</sup>, indicated a daily potable water demand of 2 189ℓ.

#### LEAK DETECTION

A remote monitoring system has been installed to monitor the performance of the water purification system as well as the daily water consumption.

The monitoring system is live and can be accessed at any time, from any point, via the internet. Readings are updated every five minutes.

A daily report is printed, showing the total water consumption for the day. At the end of each month, a monthly report is generated, showing the total daily water consumption in the building.

From the above trend monitoring, any deviations from the normal usage patterns can easily be detected. If there is a leak, the higher-than-normal consumption will be detected. The cause can be determined and the problem rectified.

#### LIST OF PROFESSIONALS

Owner	Gutsche Investment & Management Company	
Developer	Asset Matrix	
Architect/Designer	Kevin Gadd Architects	
Project manager	Kevin Gadd Architects	
Consulting engineers	Electrical	DSV Consultants
	Mechanical	Sutherland
	Wet services	Sutherland
	Civil	Sutherland

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Contractors	HVAC&R	Peninsular
	Wet services	Grinstead Plumbing
Suppliers	<ul style="list-style-type: none"> <li>• WC and urinals: Geberit</li> <li>• Taps: Newform</li> <li>• Showerheads: Bossini</li> <li>• Motors: Grundfos (Lenntech)</li> <li>• Submersible pump: Leaders Pumps</li> <li>• Bio-digesters for treatment of all waste water from the building: Agama Energy</li> <li>• Biogas burner to use biogas from the bio-digesters: Agama Energy</li> <li>• Pre-filtration by means of strainers: Malutsa</li> <li>• Pre-filtration by means of cartridge filters: Malutsa</li> <li>• Reverse osmosis purifier: Malutsa</li> <li>• Chemical dosing plant: Malutsa</li> <li>• Electronic water meters: Grinstead Plumbing</li> <li>• Remote monitoring system: GSM Commander, installed by Western Cape IT Solutions</li> <li>• Buffer tanks: Jo-Jo, installed by Grinstead Plumbing</li> <li>• Booster pump for water reticulation into the building: Supplied by Lowara, installed by Grinstead</li> <li>• SOG trickle filter added later: HWT Water Treatment. <b>PA</b></li> </ul>	

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