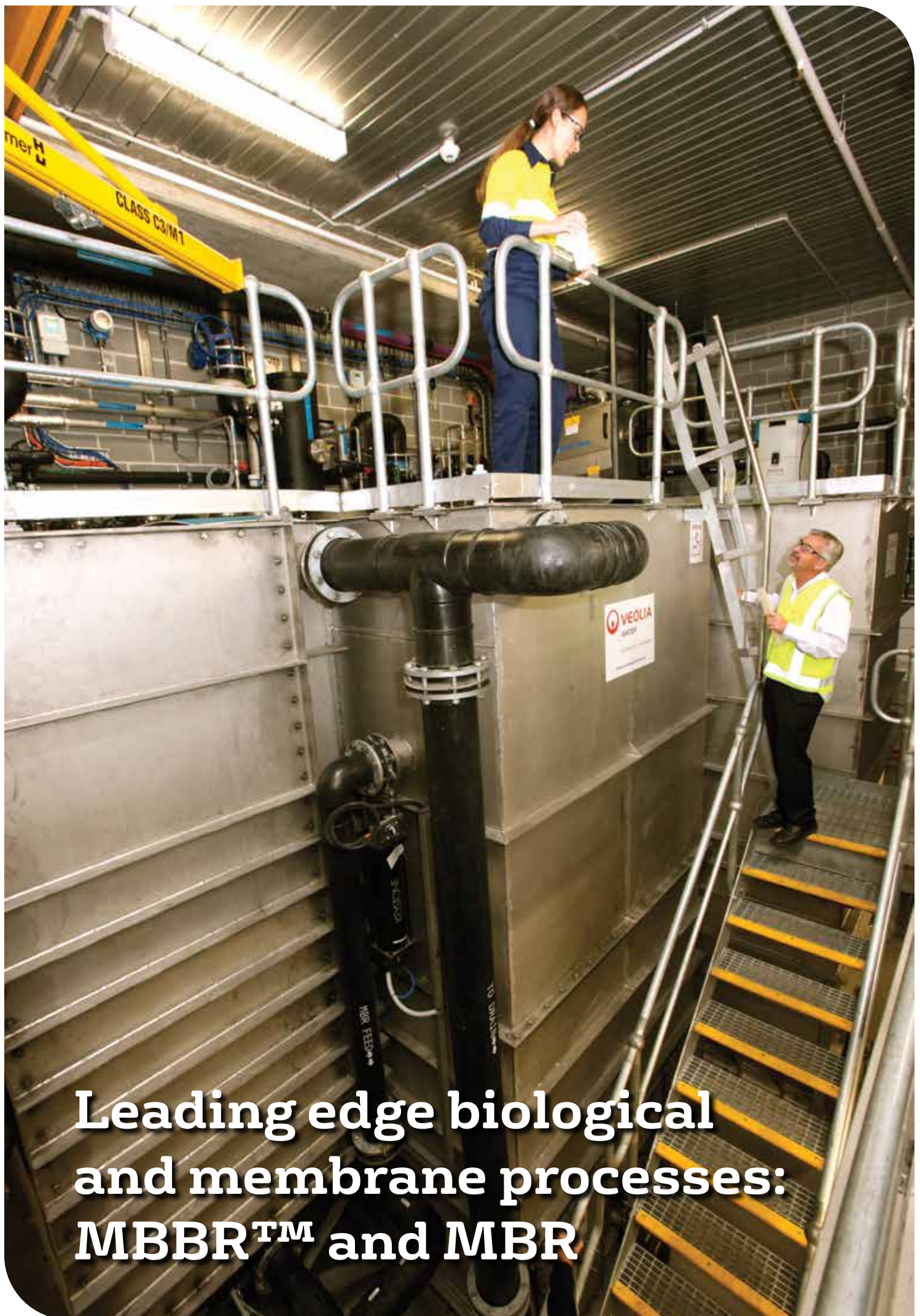




Darling Quarter Recycled Water Treatment Plant

Darling Harbour, Sydney, NSW

WATER TECHNOLOGIES



**Leading edge biological
and membrane processes:
MBBR™ and MBR**

Sydney's landmark, the Darling Quarter Redevelopment, also known as 'Commonwealth Bank Place', is a \$500 million low rise commercial office and leisure space in Darling Harbour, developed by Lend Lease for the Australian Prime Property Fund (APPF).

The Darling Quarter Precinct is located at 1 -11 Harbour Street in Darling Harbour between the Chinese Garden and Imax. The associated public domain area includes a world class new children's playground.

Setting the benchmark for green precincts, Commonwealth Bank Place has received a 6 Star Green Star – v2 Office Design certified rating by the Green Building Council of Australia (GBCA), achieving the highest score to date for a building of its size. A 6 Star Green Star rating recognises world class innovation. The buildings' design features help save 2,500 tonnes of carbon emissions per year.

The Darling Quarter Recycled Water Treatment Plant is one of the key sustainability initiatives, treating sewage to produce high quality recycled water used for cooling towers, garden irrigation and toilet flushing. Along with rainwater harvesting, these water saving initiatives will contribute to reduce potable water use by 92%.

Background

Darling Quarter (Commonwealth Bank Place) consists of two low rise commercial buildings.

It includes up to eight-storey of an A grade office space (55,418 m²), a ground level retail floor (3,789 m²), 800 car spaces, as well as a children's playground and a multi-purpose theatre. Lend Lease was responsible for the design and construction of the project.

Veolia Water Technologies, a world leading company in the design & build of water treatment plants, specialising in water reuse, was engaged by Lend Lease to design, construct and operate the recycled water plant located in the basement of the building.

Darling Quarter is managed by Jones Lang LaSalle (JLL).

The Water Industry Competition Act 2006 (WICA Licence)

Private companies require a NSW WICA (Water Industry Competition Act 2006) licence to construct, operate and maintain water industry infrastructure and another to supply the treated water produced.

These activities are regulated by IPART (Independent Pricing & Regulatory Tribunal) of NSW.

Veolia Water Technologies was granted a Network Operator's Licence to design, build, operate and maintain the Darling Quarter Recycled Water Plant, and a Retail Supplier's Licence to supply the treated water produced to the development for cooling tower make up, garden irrigation and toilet flushing.

What is sewer mining ?

Sewer mining is the process of accessing raw sewage from a sewer to treat it and produce recycled water.

At the Darling Quarter Recycled Water Treatment Plant, the sewage needed is extracted from a nearby Sydney Water sewer to be treated and meet the recycled water needs of the building.

What is recycled water ?

Recycled water is wastewater collected from offices, homes, retail & commercial users, etc, which is then treated to a very high level to make it safe for non drinking uses.

Recycled water is not suitable for drinking purposes.

What about odours ?

A risk managed approach was taken by Veolia Water Technologies and Lend Lease to the odour treatment design of the plant, ensuring that the system in place guarantees to avoid odour in any circumstance.

Tanks handling the raw sewage are completely sealed, they are vented and foul air is treated at the plant, using a monitored carbon filter. In addition, the entire plant room is sealed with the air being continuously extracted and treated through a separated odour unit. In the event, an odour issue could not be rectified quickly, the recycled water treatment plant would be shut down and the tanks emptied and cleaned immediately.

In that case, potable water would temporarily be used in the recycled water supply, until the recycled water treatment plant can operate again normally.

How does the plant work?

Leading edge biological and membrane processes, the Moving Bed Biofilm Reactor (MBBR™) and the hollow fibres UF Membrane are combined to remove very efficiently bacteria, suspended solids and BOD / COD.

This is followed by Reverse Osmosis, a membrane filtration technology, to remove the salts and particles larger than 0.0001 µm and ultraviolet and chlorination to kill bacteria, protozoa and viruses.

The recycled water at Darling Quarter is of very high quality, beyond the required Australian Guidelines for water recycling. The quality of the recycled water is monitored 24 hours a day, 7 days a week, 365 days per year via critical control points and a remote monitoring system.

Regular sampling, online monitoring and analysis ensure that the recycled water will always meet the required quality.

3

After having been through a macerator, the wastewater is pumped to a fine screen. The screen removes all particles larger than 1 mm present in the sewage.

2

The wastewater enters a buffer tank, to provide a constant flow to the recycled water treatment plant over a 24-hour period.

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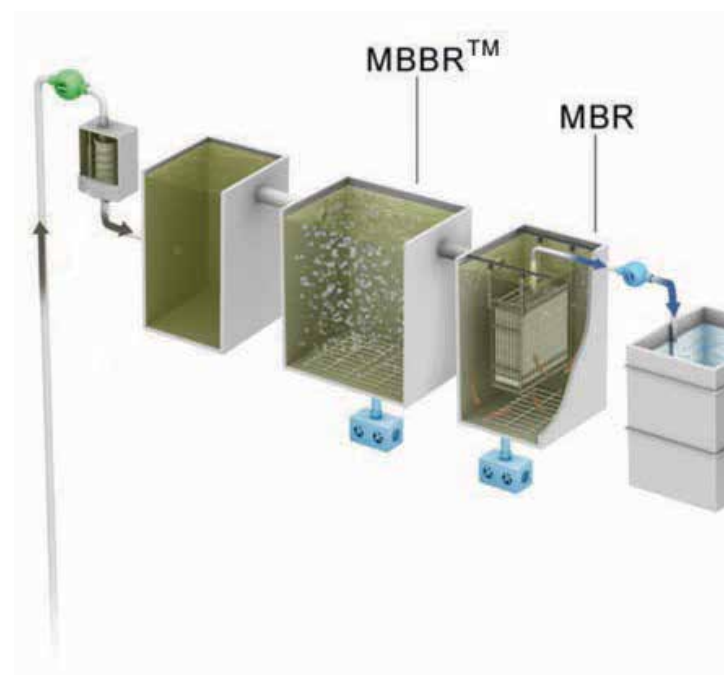
Sewage needed to meet the recycled water needs of the building is extracted from a Sydney Water sewer running close to the building ("sewer mining").

4

The MBBR™ tank is filled with specially designed plastic chips which help grow specific bacteria. The chips act as hosts for the microorganisms that grow on them.

5

The hollow fibres UF membrane ensures that all suspended particles larger than 0.05 µm are removed.





Reverse Osmosis

6

This is then followed by Reverse Osmosis, a membrane filtration process, to remove the salts and particles larger than $0.0001\ \mu\text{m}$.

Waste flows are returned to Sydney Water sewer in accordance with a Trade Waste Agreement.

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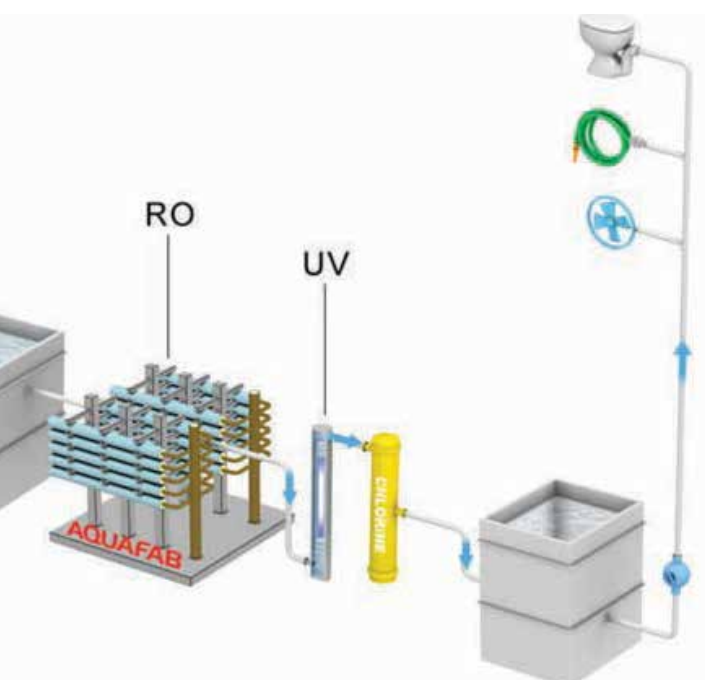
The water is then disinfected with Ultra Violet Light.

8

Then, the water is further disinfected with Chlorination. This final process removes bacteria, protozoa and viruses.

9

The recycled water is used for cooling tower make up, garden irrigation and toilet flushing.



Important notice:

While the use of recycled water at Darling Quarter is very safe, it is however important that you are aware of certain facts and general precautionary measures you may need to take with regards to recycled water:

- Recycled water, even when treated to a very high level, is not suitable for drinking purposes. You should try to avoid direct contact with recycled water.
- Should you come in direct contact with recycled water used to flush the toilets, all you need to do is wash hands with clean water or the parts of the body which have been in contact with recycled water. If splashed in the eyes, wash immediately with clean water.
- All recycled water plumbing is lilac (light purple) in colour and is to be operated and maintained only by authorised personnel, including taps in the irrigated garden areas. Please refrain from touching any lilac taps or valves which you may see around the building.
- Recycled water is also used in cooling towers. However this is a restricted area, accessible by authorized persons only, so should be of no concern to you.

Parameters	Darling Quarter Recycled Water Quality achieved after 28-day validation period	NSW Code of Practice - Management of private recycled water schemes*	Australian Guidelines for Water Recycling (dual reticulation, toilet flushing)**
BOD5	<5 mg/L	<10 mg/L	
Suspended solids	<5 mg/L	<10 mg/L	
pH	6.5-8.5	6.5-8.5	
Turbidity	<0.2 NTU	<2 (95%ile), <5 NTU	
E. Coli	<1cfu/100mL	<1cfu/100mL	<1cfu/100mL
Disinfection	0.2-2.0 mg/L	0.2-2.0 mg/L	
Coliphages	<1 pfu/100mL	<1 pfu/100mL	
Clostridia	<1 cfu/100mL	1 cfu/100mL	
Validated Virus reduction	6.6 log reduction***		6.5 log reduction
Validated Bacteria reduction	12.1 log reduction		5 log reduction
Validated Protozoa reduction	8.1 log reduction		5 log reduction

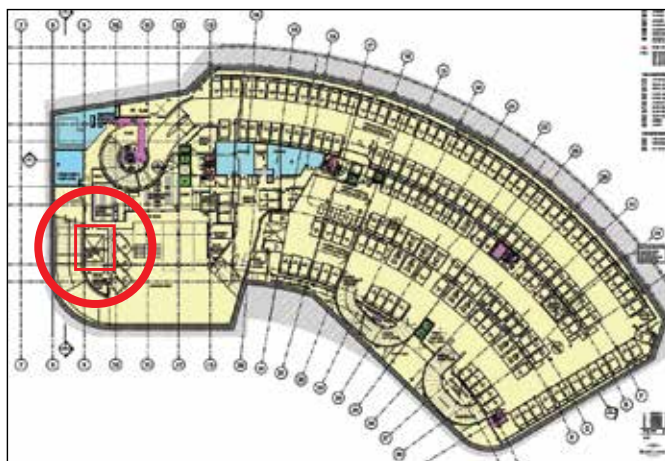
* NSW Guidelines for Management of private recycled water schemes (May 2008)

** Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) 2006

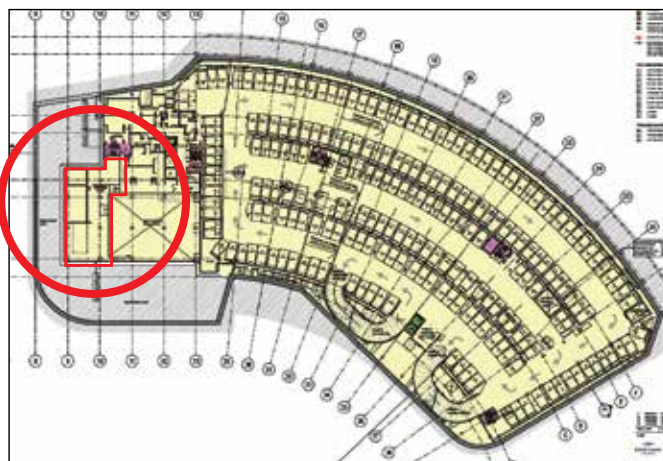
*** Log reduction: the difference between the average of the log-10 inlet and the average of the log-10 outlet concentrations. "Log" stands for the logarithmic function: 1, 2, 3 and 4 log reductions correspond to 90%, 99%, 99.9% and 99.99% reduction respectively, and so on. This log-reduction terminology was developed by engineers as a way to express levels of decreased biological contamination in water by factors of 10 that could be easily converted to percent reduction.

Location

Basement 2 of north building - First level of the plant



Basement - 3 of north building - Second level of the plant





Recycled water is used for cooling towers as well as for garden irrigation and toilet flushing.

Resourcing the world