

The Big Read: A decade on, Marina Barrage is now key to S'pore's water management

By SIAU MING EN



An aerial view of the Marina Barrage, which celebrates its 10th year anniversary this year. TODAY file photo

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SINGAPORE – While the rest of the island is sound asleep, three members of the Marina Barrage operations team monitor tidal conditions and the reservoir's water level from a control room.

After the sun comes out in the morning, another team sets off on a boat to inspect the water quality in the reservoir while others make their rounds to supervise contractors carrying out regular maintenance checks on the drainage pumps. Throughout the day, the staff at the barrage also sift through copious paperwork, including permits for water activities and event proposals.

Like a well-oiled machinery, the team – which has grown from 34 to 45 officers – has been manning the round-the-clock operations at the Marina Barrage over the last decade.


Today, some 30 years since it was first conceived and a decade since it first began operations, the barrage and the people running it have secured an important additional source of water supply, and prevented the occurrence of floods in low-lying city areas including Chinatown, Boat Quay, Jalan Besar, Geylang and Shenton Way.

**Lee Hsien Loong** 
about 2 years ago

Today is World Water Day, reminding us that water is a precious and critical resource for everyone.

Singapore relies heavily on our numerous reservoirs for our water supply. The largest of these is the Marina Barrage. A dedicated team from PUB, Singapore's National Water Agency keeps the Barrage in good working order 24 hours a day, every day. This TODAY report tells the story of the work they do and of the Barrage, which turns 10 this year.

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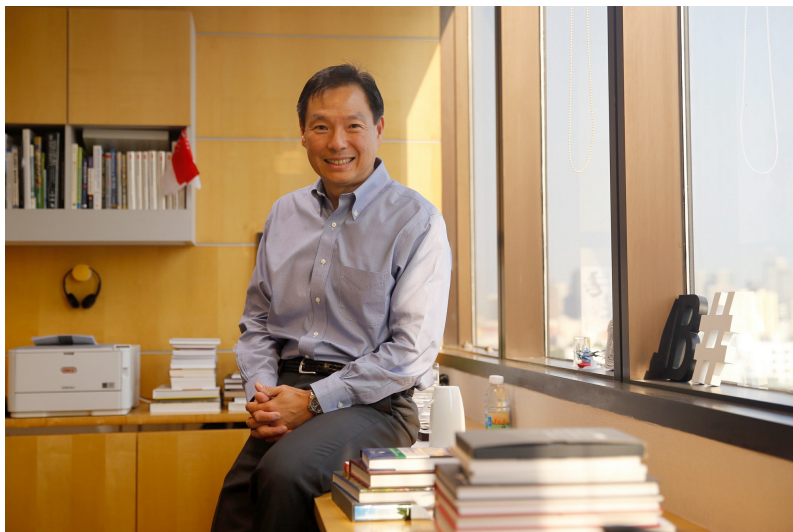
Photo: Najeeb Yusuf/TODAY

Officially opened to the public in October 2008, the S\$226-million barrage is Singapore's first reservoir in the heart of the city, and it boasts the largest catchment area at 10,000 hectares, or one-sixth the size of the island. Drains from as far as Ang Mo Kio, Orchard, Paya Lebar to Alexandra channel rainwater into the Marina reservoir.

A series of activities has been lined up this year to mark the 10th anniversary of a project whose origins can be traced back to 1987 when founding Prime Minister Lee Kuan Yew threw down the gauntlet for national water agency PUB, in these immortalised words: "In 20 years, it is possible that there could be breakthroughs in technology, both anti-pollution and filtration, and then we dam up or put a barrage at the mouth of the Marina – the neck that joins the sea – and we will have a huge freshwater lake."

Apart from serving its strategic purposes, the barrage has also – to the pleasant surprise of its planners – become an iconic feature of the Marina Bay backdrop, endearing itself to the young and old: On weekday evenings, its green roof would be occupied with dating couples or office workers unwinding after a long day, while runners and tourists stream through its premises sprawling more than 240ha. On weekends, families with children and pets in tow flock there for picnics and kite-flying, while water sports enthusiasts take part in various activities in the serene waters.

Since its opening, close to 15 million people have visited the Marina Barrage. "We never ever imagined it will be so popular," PUB chief executive Ng Joo Hee told TODAY in an interview earlier this week.



PUB's chief executive Ng Joo Hee. Photo: Najeeb Yusuf/TODAY

FROM CONCEPTION TO REALITY, A VISION WHICH EVOLVED

The Marina reservoir is served by five major rivers – Kallang River, Geylang River, Singapore River, Rochor Canal and Stamford Canal.

Since 2011, with the completion of the Marina, Punggol and Serangoon Reservoirs, Singapore's water catchment area has increased from half to two-thirds of its land surface.

The idea for Marina Barrage came from the late Mr Lee in 1987, after the authorities spent 10

years cleaning up the Singapore River.

Speaking to TODAY, PUB chief sustainability officer Tan Nguan Sen noted that the barrage would not have been feasible if the Singapore River was still polluted. Once the Marina Channel was dammed up, all the rubbish would be stuck in it, he said.

“But because we cleaned up the Singapore River, it created a new possibility,” added Mr Tan.



A boat hoist is used to transfer vessels over the barrage. Photo: Raj Nadarajan/TODAY

Even so, Marina Barrage’s eventual “three-in-one” function was not conceived right from the beginning.

When the idea was first mooted in 1987, Mr Tan said the “key function” the authorities was working towards was flood control. Singapore has had a long history of floods. In December 1978, heavy rain fell over Singapore for a day and caused a major flood. Seven people died, and more than a thousand others had to be evacuated from their homes as livestock and poultry were lost.

The Republic’s planners also did not think much about having the barrage as a source of drinking water then, as membrane technology – now used to turn sea and used water into drinking water – did not exist at that time. If anything, the authorities had considered treating the water for non-potable uses, but not for drinking.

Thanks to improvements in membrane technology in the 1990s, it became “cheap and viable” to treat the water to achieve drinking water standards, paving the way for one of the barrage’s core functions.



The barrage dam doubles up as a pedestrian bridge. Photo: Raj Nadarajan/TODAY

It was also not until later, while designing the place, that the authorities realised its potential as a recreational spot. They found that the Marina reservoir would be suitable for water activities once the dam was built as water levels could be kept constant.

This was also in line with a shift in government policy in 2006, when then-Minister for the Environment and Water Resources Yaacob Ibrahim decided to open up the reservoirs to the public. “That was a paradigm shift,” said Mr Tan.

Construction work on the Marina Barrage kicked off in 2005. Three years later, the barrage was finally opened to the public.

KEEPING FLOODS AT BAY

A decade after it began operations, has the Marina Barrage achieved its purposes?

Mr Ng had no doubt: “Absolutely.”

As the country’s 15th reservoir, the Marina reservoir serves as a source of drinking water for Singaporeans, he added. The reservoir stores fresh water collected from the extensive catchment areas before it is treated for drinking water.



The pump room that holds 7 drainage pumps that are 7.8m in height. Each pump can drain the equivalent of an Olympic-sized swimming pool in a minute. Photo: Raj Nadarajan/TODAY

By keeping the seawater out, the Marina Barrage removes “tidal influence” from low-lying city areas in the Marina catchment, PUB said. Prior to the construction of the barrage, these areas were prone to flooding whenever very heavy rain coincided with high tides.

Specifically, the barrage isolates the Kallang, Geylang, Singapore Rivers, Bukit Timah, Rochor and Stamford canals as well as their connecting drains from the influence of the tide, PUB added.

Mr Ng noted that it was not possible to quantify how many floods the barrage successfully averted. Nevertheless, he noted that every day, the team at the facility is kept busy operating the pumps and the gates, depending on the water levels.

The barrage depends on its nine crest gates and seven drainage pumps to prevent floods from occurring. When heavy rain – which causes the water level in the reservoir to rise – coincides with the low tide, the 30m steel gates are opened to release the excess storm water into the sea.



When heavy rains coincide with low tide, there are 9 30m crest gates which can be opened to release excess storm water. Photo: Raj Nadarajan/TODAY

But if a heavy downpour happens when there is a high tide, the drainage pumps kick in to drain the excess water from the reservoir. Each pump can drain 40 cubic metres of water per second, which is equivalent to draining out an entire Olympic-sized swimming pool in a minute.

As Mr Ng put it, the Marina Barrage is “one piece in a very large and integrated water system” in Singapore. It may not always be possible to isolate its contributions to the overall flood prevention measures here, but he wanted to debunk the “urban myth” which blamed the barrage for the Orchard Road flooding in June 2010.

It was the worst flood in Orchard since the Stamford Canal, which helps drain the rainwater, was widened in 1984.

Some had speculated that the barrage did not pump the water out quickly enough to prevent

the floods. But PUB said then that the Marina Barrage was not to blame and its gates had been opened to release the excess water, and this prevented other low-lying areas from flooding.

A report by an expert panel in 2012 found that the flooding was due to higher rainfall intensities, which led to surface runoff which overwhelmed the Stamford Canal. The heavy build-up of debris in the canal could have contributed to the floods as well.

Following the incident, the frequency of maintenance inspections of critical closed drains were stepped up from quarterly to monthly. More litter traps in the open sections of drains were also installed, among other measures.

A MASSIVE TEAM EFFORT

Unbeknownst to the public, it requires much work to keep the barrage running 24/7 and ensure it meets the operational demands.

Leading the effort is the facility's general manager Noorazman Noorain, 39. Depending on the priority of the day, he could be found anywhere in the barrage, from the reservoirs to check on the water quality, the pump room to oversee maintenance works, or at the green roof to prepare for upcoming events.



Noorazman Noorain, General Manager of Marina Barrage. He oversees a team of 44 who handle round the clock operations of the barrage. Photo: Raj Nadarajan/TODAY

In all, the work of running the place is split among five teams: an operations team to operate the gates and drainage pumps round the clock; a maintenance crew; a team to monitor water quality, collect samples and ensure cleanliness; a department to manage the water activities in the reservoir, including conducting checks and audits on users; and another to oversee the use of the facilities and events by external parties.

The operations team opens the gates or runs the drainage pumps according to the weather and tidal conditions. This prevents flooding at the nearby low-lying areas.

Twice a day, others such as senior assistant engineer Muhamad Fazly Ismail, 38, checks the quality of the reservoir's water, such as its temperature, pH values and salinity, among other things. He and his team also patrol the area and take enforcement action against those flouting the rules in the waters.



Muhamad Fazly Ismail, Senior Assistant Engineer, is in charge of checking water quality in the reservoir and maintenance of the reservoir. Photo: Raj Nadarajan/TODAY

His colleague, senior assistant engineer Nazimudeen Mohamad, 36, and his team oversee maintenance works at the barrage. The drainage pumps for instance, are subjected to

different checks weekly, fortnightly, monthly, and so on.



Nazimudeen Mohamad, Senior Assistant Engineer, oversees the maintenance of drainage pumps at the Marina Barrage. Photo: Raj Nadarajan TODAY

The team would be on high alert just before the monsoon season to make sure the pumps are functioning properly to cope with the heavy rainfall swelling the water level in the reservoir.

Then there is senior manager Jessie Chew, 51, and her team which manages the events held at the barrage. These range from picnics, National Day celebrations, flash mobs, wedding proposals and celebrations to marathons, where the barrage becomes part of the running route.

Ms Chew's team gets at least 10 enquiries a week to hold events at the barrage.

While the work is growing, there are no plans for now to increase the total staff strength. Instead, the existing members will tap on technology to do more, said Mr Noorazman. Some of the new technology already being tested include unmanned online monitoring systems, robotic swans in the water to monitor water quality, and predictive systems that can identify problems or abnormalities early on.

A RESERVOIR OF GOODWILL

While Singapore's planners are known for their far-sightedness and attention to detail, the reception from the public towards the new addition to the Marina Bay backdrop was entirely unexpected.

Said Mr Ng: "We are not in the tourism business, so operating the place like a tourist attraction is not our core business and this is something we learned."

He added: "So now we don't just have to keep it good shape, making sure it works as a water infrastructure, we also have to make sure it remains attractive as a tourist attraction."

While Mr Tan felt that some visitors may not fully appreciate the important functions of the barrage, Mr Ng noted that having more people on its grounds gives PUB the opportunity to do public outreach and education.

Likewise, water experts said the 10th anniversary is also a chance to remind the public about the Marina Barrage and the need to keep waterways clean.

Senior research fellow at Lee Kuan Yew School of Public Policy Joost Buurman noted that very few places in the world collect water from such an urbanised area given the potential exposure to various forms of pollution.

To commemorate the barrage's 10th anniversary, PUB is holding a series of events such as a mass yoga session, line dancing and water sports next month, as well as cycling clinics in May.

To cap off the celebrations, PUB will also be bringing in some 50 to 100 local and foreign food and craft vendors from Oct 26 to 28. Visitors will get to take a special boat tour around the Marina reservoir during this event.

CHALLENGE OF CLIMATE CHANGE

While the barrage has come a long way over the last decade in achieving its stated purposes and more, there are new challenges to surmount – and few come as big as climate change, which will cause sea levels to rise in the long term, and more extreme weather condition in the near term.

Already, Singapore has been experiencing more erratic weather, with sudden intense downpours requiring the Marina Barrage staff to be alert and vigilant.

Said Mr Tan: "When we started planning, it was in the 1990s. There was not much (talk) about climate change then and we assumed the sea level would remain the same."

According to Singapore's Climate Action Plan published in 2016, sea levels are projected to

rise between 0.25m and 0.76m towards the end of the century.

To this end, PUB is studying the possibility of improving existing structures for instance, to protect the facility from rising sea levels.

The agency noted that climate adaptation planning is “an ongoing effort involving many agencies”.

While Singapore’s existing coastal reservoir structures are adequate for the current sea levels, PUB said it has to “look long term to study various possible measures to protect our coastal reservoirs against future sea level rise”. This is being done as part of the coastal adaptation study led by the Building and Construction Authority, PUB said. “The possible measures include the installation of buffer beams and retrofitting of the tidal gates’ structure. As the study is ongoing, estimated costs are not available now,” it added.

Given the success of the barrage, are the authorities planning to build another one on a different part of the island?

At the Marina Barrage commencement ceremony in 2005, the late Mr Lee had challenged the PUB to extract untapped water sources from other parts of Singapore, such as the Jurong West area where industries are located.

Asked about future plans, Mr Ng would only say that PUB is always seeking to maximise the country’s water resources and if the opportunity arises, it will look at building another barrage.

Dr Cecilia Tortajada, a senior research fellow at Lee Kuan Yew School of Public Policy, said a project the size of the Marina Barrage would be difficult to develop somewhere else on the island, and it does not necessarily require a similar project to draw water from untapped sources in Jurong West.

Noting PUB’s innovativeness in managing Singapore’s water systems, she said: “If there is any possibility... they will develop it.”

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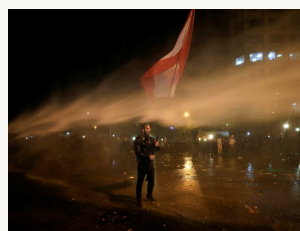
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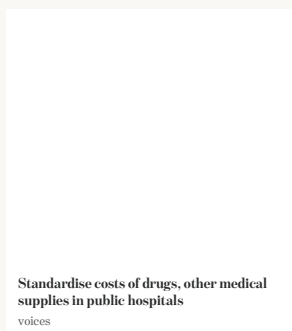
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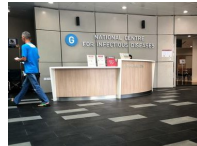
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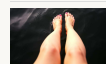
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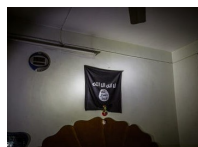
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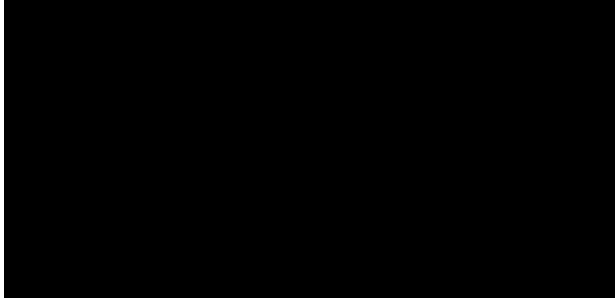
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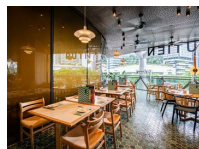
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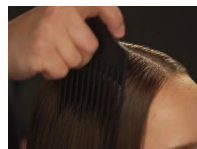
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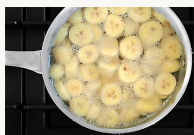


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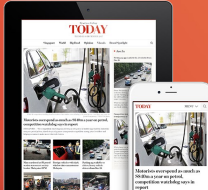
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