

A Singapore icon turns 10!

Series of celebrations revolve around 3-in-1 functions of Marina Barrage

Singapore, 13 February 2018: Built across the mouth of the Marina Channel, the Marina Barrage creates Singapore's 15th reservoir, and the first in the heart of the city. With a catchment area of 10,000 hectares, or one-sixth the size of Singapore, the Marina catchment is the island's largest and most urbanised catchment.



Officially opened by Prime Minister Lee Hsien Loong on 31 October 2008, the Marina Barrage celebrates its 10th birthday this year.

Three-in-One Benefits

Marina Barrage is the vision of the late Mr Lee Kuan Yew, the first Prime Minister of Singapore, more than two decades ago when he envisaged damming the mouth of the Marina Channel to create a freshwater reservoir. As a showcase of urban water sustainability, the barrage brings about three benefits.

Flood Alleviation

First, the barrage is part of a comprehensive flood control scheme to alleviate flooding in low-lying city areas. It has a set of nine crest gates and seven drainage pumps, operationally-ready to serve at any time.

Before the Marina Barrage was created, the Marina Channel was an open channel leading to the sea. When heavy rain coincided with high tide, low-lying areas in the city such as Chinatown, Boat Quay, Jalan Besar and Geylang would be prone to flooding. During extreme high tides, even when there was no rain, these areas may also flood.

With the Marina Barrage in place, the reservoir is separated from the sea, and is no longer affected by tides. When heavy rain occurs and the water behind the Barrage builds up, excess storm water can be discharged into the sea through the crest gates, or the pumps. This helps to minimise the risk of floods (see ANNEX A on Marina Barrage's pumps and gates operation).



Water Supply Source

Second, the barrage creates a reservoir in the city served by five major rivers running through the heart of the city – Kallang River, Geylang River, Rochor Canal, Singapore River and Stamford Canal. Together with the Punggol and Serangoon Reservoirs, the Marina Reservoir, which was commissioned in 2010, increased Singapore's water catchment from half to two-thirds of the island's land area.



As a reservoir with a large catchment, it is important to ensure that raw water quality in the catchment is of good quality. PUB has a holistic water quality management and monitoring programme that safeguards our water quality right from the source. These include nutrient control from diffused sources in the catchment, water pollution control legislation and policy, and robust online water quality monitoring and samples collected for laboratory tests.

At Marina Reservoir, online monitoring systems track real-time water quality data, complemented by the collection of water samples for testing. In recent years, PUB has also leveraged on robotics and SMART technological solutions such as robotic SWANs¹ to boost our water monitoring efforts. Better raw water quality will contribute to cleaner waters and an even more attractive environment in and around the reservoir.

Lifestyle Destination

Third, unaffected by tides, the water level in the Marina Reservoir is kept constant all year round. This creates an ideal venue for various recreational and lifestyle activities such as kayaking, sailing and dragon boating.



Since its opening, the Marina Barrage has welcomed close to 15 million visitors from near and far and from all walks of life. These dignitaries include the President of the Republic of Hungary, Janos Ader; the Prime Minister of Cambodia, Samdech Techo Hun Sen, Princess of Thailand, HRH Maha Chakri Sirindhorn; former Secretary-General of the United Nations Ban Ki-Moon, former Vice Premier of the People's Republic of China, Wang Qishan; and the late President of Singapore, S.R. Nathan. The Marina Barrage and the Marina Reservoir have also hosted more than 100 national and international events, including the SEA Games 2015, the Singapore River Regatta and the Army Half Marathon.

¹ SWAN or Smart Water Assessment Network is an autonomous robotic platform that conducts real-time water quality monitoring at reservoirs.

Besides water activities, the barrage has also attracted visitors from all walks of life, with families and friends gathering at this lifestyle destination for picnics, kite-flying or simply checking out the numerous events taking place every week.

Good water quality in the reservoir makes it possible for these recreational activities to take place. Help keep our reservoir clean so that present and future generations can continue to enjoy this beautiful blue space.

Something for the whole family!

Kicking off the celebrations is an exhibition that brings visitors “behind the scenes” to understand the intricacies behind this engineering marvel and how its gates and pumps function in flood control.

The Marina Barrage has lined up a series of ten fun and exciting activities for the whole family starting this month. In the months leading to October, visitors can look forward to a myriad of events and activities, including “Get Active @ Marina Barrage”, Kite Day @ Marina Barrage” and “RSAF50 @ Marina Barrage”. The grand finale of the festivities will take place on 26 to 28 Oct where the barrage will metamorphose into a carnival-like pop-up market, featuring local and international food, crafts and acts all under one roof. On 27 and 28 Oct, members of the public can also experience cruising right in the heart of the Marina Reservoir and learn about the creation of this urban reservoir through a specially-arranged boat tour that sets off from Marina Barrage. Gracing the Finale Bash on 27 Oct as Guest-of-Honour is Deputy Prime Minister Teo Chee Hean.



So come down with your family and friends to join in the celebrations as we relive our memories and rediscover the significance of this engineering feat. All visitors stand to receive a limited edition commemorative picnic mat (see ANNEX B for events listing)!

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Behind the scenes

In the months of April and May, engineering students from Institutions of Higher Learning will, for the first time, have the rare opportunity to join a technical tour that offers a sneak peak to areas usually closed to public, including the pump house where the seven mammoth drainage pumps are sited and the operations control room where PUB officers access flood control equipment remotely and manage various systems.

Through this exposure, students will gain a deeper appreciation of the ingenious utility and the complexities behind the operation and maintenance of the gigantic crest gates and pumps.

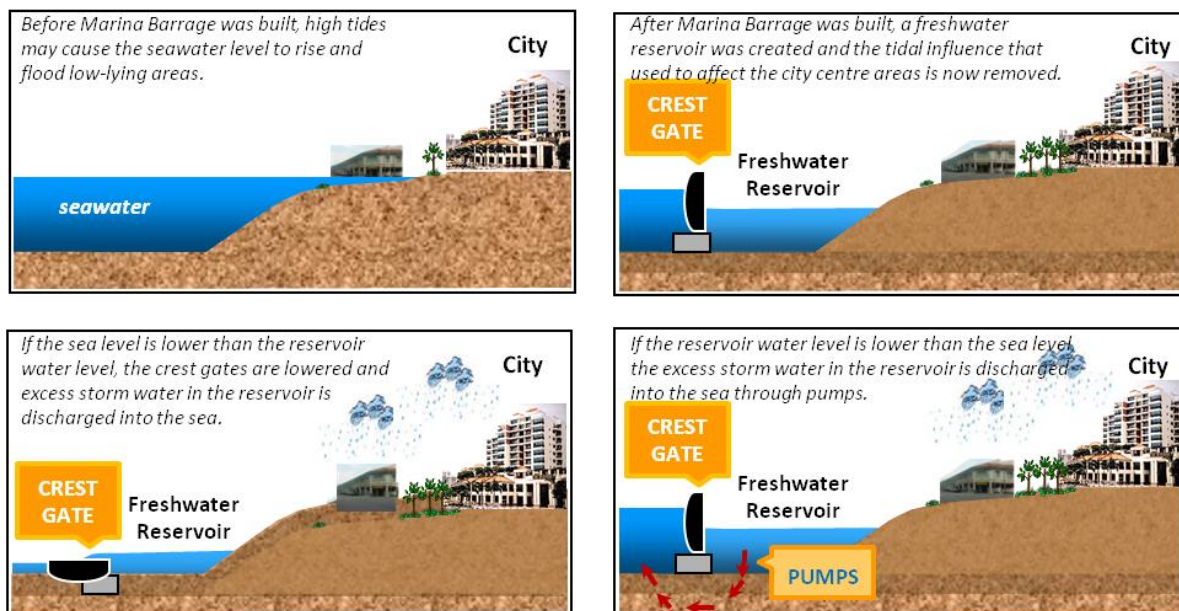
Awards, Achievements, Accolades

Marina Barrage demonstrates how an urban water solution can be effectively utilised to meet water needs, while enhancing the living environment for a better quality of life.

Over the years, the Marina Barrage has received numerous accolades and awards, both locally and internationally, including the Superior Achievement Award - the highest honour for the best project entry - at the American Academy of Environmental Engineers Annual Awards, becoming the second project outside of USA to win the award in the last decade, ASEAN Outstanding Engineering Achievement Award in 2007 and International Water Association Asia Pacific Regional Project Innovation Awards (Design Category Winner) in 2010 (see ANNEX C).



How the Marina Barrage's Crest Gates & Drainage Pumps work



The Crest Gates

The Marina Barrage has a system of nine identical crest gates, each measuring 29.75m in width and 5m in height.

When it rains heavily during low tide, the crest gates can be opened to release excess storm water into the sea. It takes about 25 minutes for each gate to be fully opened.

Each crest gate is operated by 2 hydraulic cylinders (located at both sides of the gate) and a hydraulic power unit with working pressure up to 200Bar. The operation of the crest gates is measured and determined by a calibrated set of sensors that tracks the difference in water levels, enabling timely operation when required.

With the complexity of the system, and the gates exposed to the harsh environment 24/7, routine maintenance of these structures is important. PUB uses both manpower and machinery to ensure that the crest gates continue to function well.

The Drainage Pumps

The Marina Barrage has a set of seven drainage pumps. As one of the largest pumps in the world, each pump towers at 7.8m in height with a huge 3.2m diameter five-bladed impeller.

When it rains heavily during high tide, the drainage pumps will be activated. Each pump is capable of pumping 40m³ of water per second – equivalent to emptying an Olympic-size swimming pool in 60 seconds. This drains excess storm water into the sea and lowers water level in the Marina Reservoir.

Each pumping system comprises the following:

- Vertical pump
- Gear Box
- High-tension Motor
- Cooling Water System
- Siphon Breaker System
- Air compressor system

To ensure that the drainage pumps are operationally-ready to function at any time, PUB checks and maintains all parts of the pumps' sub-systems regularly.

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ANNEX B

A perfect ten – 10 events to commemorate MB’s 10th anniversary!

DATE	EVENT	VENUE	HIGHLIGHTS
24 Feb to end Oct	“Behind the scenes” – What makes the Marina Barrage tick?	Marina Barrage	The exhibition, specially curated to commemorate the Marina Barrage’s 10 th anniversary, aims to provide visitors a better understanding of how the barrage was created, the intricacies behind the engineering marvel and “behind-the-scenes” videos of how the gates, pumps and the Marina Reservoir are maintained.
10 March	Arts in your Neighborhood @ Marina Barrage	Marina Barrage Green Roof	The National Arts Council aims to bring engaging arts experiences to different neighborhoods in Singapore, encouraging Singaporeans from all walks of life to embrace, appreciate and participate in arts and culture. Enjoy interactive arts programmes by established artists and arts groups at Marina Barrage.
14 April	Get Active @ Marina Barrage	Marina Barrage & Marina Reservoir	Marina Barrage is a hot spot for exercise and fitness activities. Many activities such as brisk walk, yoga, cycling and take place at Marina Barrage regularly. Look forward to a day full of land and water sporting activities as we encourage the community to be active and have fun with their loved ones. Mass Yoga, K-robic, line dance, water sports and many more are available for the community to try out!
26 May	Adventure Cycling @ Marina Barrage	Marina Barrage Level 1	Experience cycling along the reservoir, surrounded by the beautiful cityscape. Participate in safety workshops and cycling clinics; learn how to maintain bicycles and much more...

9 June	Movie Marathon @ Marina Barrage	Marina Barrage	Picnic and catch a movie right by the blue waters and under the starry sky on Marina Barrage's iconic green roof. Fringe activities such as a photo booth, inflatables, balloon sculpting and a variety of snacks will also be brought in for a complete entertainment experience.
28 & 29 July	Kite Day@ Marina Barrage	Marina Barrage Green Roof	Singapore Kite Day is one of Marina Barrage's annual flagship events since 2010. Fliers from different countries come together to showcase their beautiful gigantic kites, demonstrate their flying skills and perform kite stunts. Magnificent kites will be on display around the installation, while the colourful wind garden display provides an ideal backdrop for a photo opportunity.
9 Aug	NDP Celebration @ Marina Barrage	Marina Barrage Green Roof	<p>Every year, thousands of people gather on August 9 to celebrate Singapore's birthday.</p> <p>Since 2008, Marina Barrage has been organising NDP-related activities. This year's concept is to transform the barrage into a big playground filled with big inflatables, exciting bubble machines, snacks, drinks and stage performances. The visitors can view a "live" telecast of the parade from the LED wall.</p>
11 & 12 Aug	RSAF50 @ Marina Barrage	Marina Barrage Green Roof	Held over the National Day weekend, Singaporeans are invited to bring their families for a picnic at Marina Barrage while viewing the commemorative RSAF50 aerial flypast comprising more than 20 RSAF flying assets and aerial displays by the F-15SG, F-16C/Ds and AH-64Ds.
2 Sept	Swap Le @ Marina Barrage	Marina Barrage Level 1	<p>Swapping is the new shopping experience. At Swap Le, you can swap clothes, books toys and more. Help to spread the message of reduce, reuse and recycle and do your part for the environment.</p> <p>This is a day that promotes environmental sustainability and a day filled with awesome music, activities and snacks.</p>

26 to 28 Oct	Finale Bash	Marina Barrage	To mark the end of the 10 th anniversary celebration, the Marina Barrage will be transformed into a “Mini Art box” on the last weekend of October. About 50 to 100 local and foreign food vendors and crafts will be brought in for this event. Beautiful tunes and beats will set the mood and entertain the crowd. A special boat tour around the Marina Reservoir will be organized for the public to experience the efforts that PUB took to ensure a sustainable water supply for all. Finally, a spectacular pyrotechnic display will end our celebrations on a high note.
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Awards Received by Marina Barrage

1. Institution of Engineers Singapore Prestigious Engineering Achievement Award 2007 (Aug 2007)
2. ASEAN Outstanding Engineering Achievement Award 2007 (Nov 2007)
3. American Council of Engineering Companies of Massachusetts Engineering Excellence Awards - Grand Conceptor Award 2009 (Overall Grand Prize) (Mar 2009)
4. American Academy of Environmental Engineers Excellence in Environmental Engineering Competition - Superior Achievement Award 2009 (May 2009)
5. Building & Construction Authority Green Mark Awards - Platinum Award for Infrastructure 2009 (May 2009)
6. International Water Association Asia Pacific Regional Project Innovation Awards - Design Category Winner 2010 (Jun 2010)
7. International Water Association Global Project Innovation Awards – Honour Award Design Category 2010 (Sep 2010)
8. Building & Construction Authority Universal Design Awards – Silver Award for Outdoor Spaces & Structures 2011 (May 2011)
9. Building & Construction Authority Construction Excellence Award 2011 - Civil Engineering Project Category (2011)
10. Singapore Good Design Mark – Platinum Award for Social (Products) – Space, Architecture Facility for the public (Mar 2014)

About PUB, Singapore's National Water Agency

PUB is a statutory board under the Ministry of the Environment and Water Resources. It is the national water agency, and manages Singapore's water supply, water catchment and used water in an integrated way.

PUB has ensured a diversified and sustainable supply of water for Singapore with the Four National Taps (local catchment water, imported water, NEWater, desalinated water).

PUB calls on everyone to play a part in conserving water, in keeping our waterways clean, and in caring for Singapore's precious water resources. If we all do our little bit, there will be enough water for all our needs – for commerce and industry, for living, for life.

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