left:
Before and after—transforming from its previous guise as a concrete canal into a picturesque river teeming with life

ABC WATERS AT KALLANG RIVER@BISHAN-ANG MO KIO PARK

AGAINST *the* ODDS, A RIVER *is* REBORN

It meanders for 3km through the heartland in central Singapore, wild flowers growing on its lush grassy banks, painting a picture of tranquillity. The waterway is also home to a celebrated family: wild otters.

The river and its banks as well as its flora and fauna are what nature would produce – except they are not. They're all an engineering creation, man-conceived and -made.

The Kallang River@Bishan-Ang Mo Kio Park was transformed from its previous guise as a concrete canal under national water agency PUB's Active, Beautiful and Clean Waters (ABC Waters) Programme, and is a testament to what engineers can do.

above:
Materials for the bioengineered slope were recycled, plants were grown from leftovers of trees that NParks trimmed, and stones that form the river bed were once concrete of the old canal

The determined engineers ignored scepticism surrounding the project, triggered by unpredictable weather conditions in Singapore, and applied intricate techniques and innovative ideas, and pressed on.

ABC Waters was born out of PUB's paradigm shift in securing its water sources, explains its chief sustainability officer Tan Nguan Sen.

"In the past, we said people couldn't go near our reservoirs because it's our pristine water source," says Nguan Sen, who was then director of the water agency's Catchment and Waterways Department. "Today, instead of keeping people away, we ask how we can allow the public to go near reservoirs safely, enjoy them and make use of the water space for recreation."

Recognising the potential reservoirs and waterways have in enhancing the liveability of Singaporeans, the canal running along the Bishan-Ang Mo Kio Park was transformed into a naturalised river. It meanders into the park and is accessible to the public during dry weather.

No walk in the park

Work on designing the river began in March 2008 and construction kicked off 19 months later. Nguan Sen says engineers were well aware of Singapore's unpredictable climate and its heavy storms, which could cause water levels in the river to rise fast and endanger lives. "It was a challenge designing the river to

make it safe and yet functional. That's what makes this project stand out."

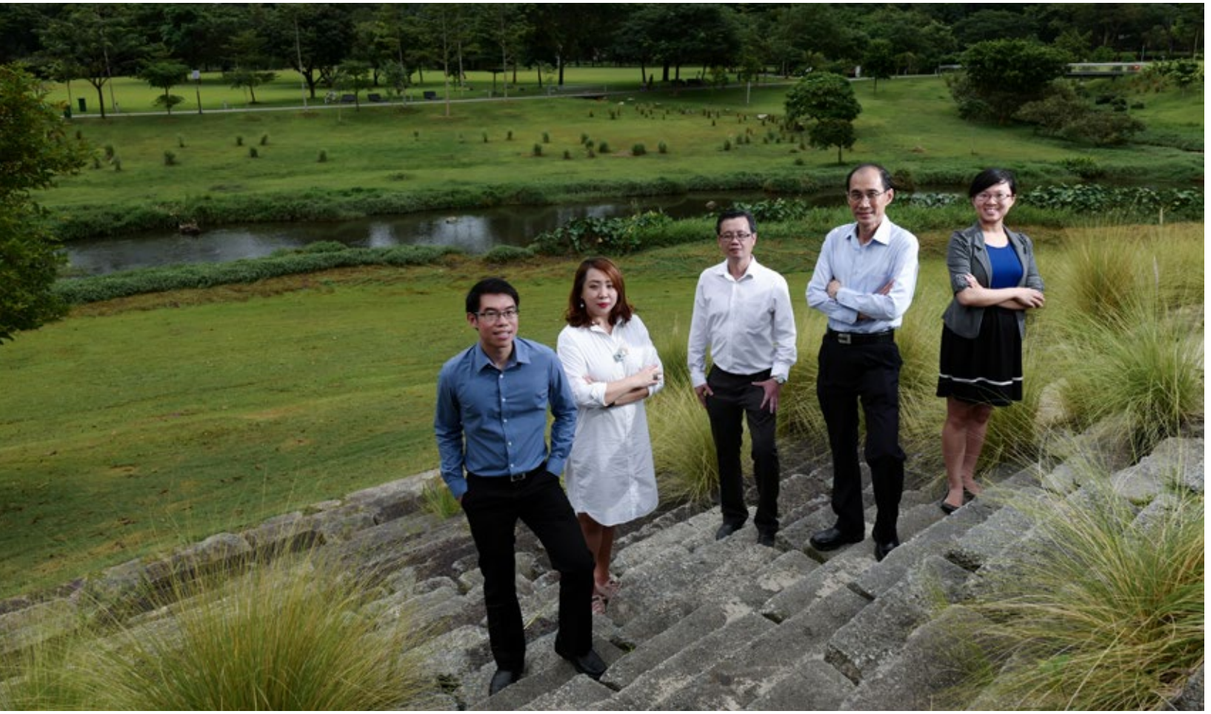
To solve this, measures such as safety nodes and water level sensors at strategic locations along the river were implemented. When there is a warning of impending heavy rain or when water levels start to rise, the nodes sound an alarm and broadcast a pre-recorded warning in English, Malay, Mandarin and Tamil for people to vacate the river. A blinking red light also starts to flash.

bottom:
L–R: Yau Wing Ken, He Qihui, Sam Ow Peng Peng, Tan Nguan Sen and Nikki Ye

"The biodiversity of the river is something satisfying...That makes us happy because you have done something right."

The safety features were not without their hiccups, says Yau Wing Ken, senior engineer at PUB's Catchment and Waterways Department. Some residents living in blocks adjacent to the river complained the sirens were too loud and the flashing red lights intrusive. So the safety features were tweaked to meet everyone's expectations without compromising on their effectiveness in ensuring the safety of park users.

"Now, the public can get close to the water and there are some who go there to watch birds," says Wing Ken, who was one of the project's planning officers. "The biodiversity of the river is something satisfying – we didn't anticipate it would create an environment that attracts birds, fishes, butterflies and even otters. That makes us happy because it shows that we have done something right."



Creative solutions

The embankment that allows residents to get near the water's edge was an engineering accomplishment in itself. Nguan Sen says the team used various soil bioengineering techniques – incorporating a combination of civil engineering and natural materials such as rocks and plants – to give the riverbanks a natural appearance while ensuring their structural integrity.

As with every first, engineers anticipated several unknowns and constructed a test bed onsite to put 10 techniques and a selection of locally available plants through rigorous tests. Seven that passed the trials were eventually selected.

"The technology was customised locally because the available know-how from overseas was not tailored to Singapore's environmental conditions," says He Qihui, who was then with the Singapore office of a US consultancy firm contracted for the project. "Foreign consultants did no work with tropical plants, so we turned to Singapore landscape and horticultural specialists to identify the plants we needed."

Engineers also wanted their project to be sustainable. So materials for the bioengineered slope were recycled, plants were grown from leftovers of trees that NParks trimmed, and stones that form the riverbed were once concrete of the old canal. Tree stumps were also converted as seats for the park.

"People don't usually do this," says Nguan Sen. "It's perhaps easier to buy off the shelf but we wanted to use materials we could get onsite. We even constructed a hill out of the concrete stones from the canal and called it the 'recycle hill'."

As an engineer, Qihui had to bring out the best from a multi-disciplinary team – from the landscape architect who focused on creating an appealing design to the hydraulics engineer who wanted the river to be efficient in preventing floods.

"They had strong views on what they wanted, but that was good because their best ideas combined to form an aesthetically pleasant yet functional river that does not flood," she points out.

above:
Various soil bioengineering techniques were employed, to give the riverbanks a natural appearance while ensuring the structural integrity of the banks

An unlikely idea triumphs

Four years after their journey began, the park opened to the exhilaration of the engineers who relentlessly toiled to turn a dream into a reality. It is the first such engineering accomplishment in Singapore and a benchmark to naturalise other canals into edifying places of recreation.

"There's really a sense of satisfaction when you see that you've built something that the public enjoys," says Nguan Sen.

For Wing Ken, the hard work in overcoming each hurdle has been vindicated. "Not every profession allows you to see your work in such an eye-catching way. When you are able to see the outcome of the product you worked on, it's rewarding."

Qihui, who is now PUB's senior engineer in the Catchment and Waterways Department, says their work answers sceptics who questioned their efforts because the project relied on a lot on assumptions and testing instead of established formulas.

"We proved that it can be done," she adds. "And when you get messages from people telling you that they were amazed by the project, it really makes your day."