

EMBARGOED TILL 12PM ON 7 SEPTEMBER 2023

Singapore's first Centre of Excellence to drive coastal protection and flood management research

New centre launched to build long-term capability and pipeline of professionals in coastal protection and flood management

Singapore, 7 September 2023 – PUB, in partnership with the National University of Singapore (NUS), today launched the Coastal Protection and Flood Resilience Institute (CFI) Singapore. It is Singapore's first Centre of Excellence dedicated to strengthening local capabilities and expertise in coastal protection and flood management research and solutioning. The centre was launched at an event attended by Minister for Sustainability and the Environment Grace Fu, along with over 200 guests comprising researchers, students, and industry professionals.

2 **CFI Singapore** is established as a multi-institutional and inter-disciplinary research centre, bringing together the strengths of our various local universities, research institutes as well as the industry. NUS has been appointed as host of CFI Singapore and will be working closely with partner institutes Nanyang Technological University (NTU), Singapore University of Technology and Design (SUTD), Singapore Institute of Technology (SIT), and the Agency for Science, Technology, and Research (A*STAR), as well as industry partners to carry out research projects to advance core domain knowledge and innovative solutions for Singapore. CFI Singapore will be led by Professor Richard Liew, head of the Department of Civil and Environmental Engineering at the NUS College of Design and Engineering.

Strengthening Singapore's resilience against rising seas and extreme rainfall

3 Climate change is bringing about more extreme weather with more intense rainfall and sea level rise. Beyond its role in drainage planning and stormwater management, PUB was appointed the national coastal protection agency in 2020. PUB has since embarked on master-planning and site-specific studies, strengthened competencies in coastal hydrodynamic modelling, and launched research initiatives to develop effective strategies to safeguard Singapore's resilience against the impacts of climate change. CFI Singapore is a key pillar under PUB's **\$125 million Coastal Protection and Flood Management Research Programme (CFRP)**¹ that will galvanise research and technology development in coastal protection and flood management. In addition to CFI Singapore, the CFRP will also facilitate test-bedding of new solutions and accelerate the translation of technologies for application through the **Applied Research** and **Living Lab** components.

4 Building on expertise across the various institutions, research centres and the industry, CFI Singapore is responsible for conducting cross-disciplinary research to achieve several key objectives:

- Generate core knowledge in coastal science;
- Develop coastal protection and flood management solutions suited for Singapore's urban and land-constrained coastlines;
- Promote a collaborative research ecosystem encompassing local and international universities, researchers, and industry partners;
- Train a new generation of researchers and engineers to meet Singapore's long-term challenge for coastal protection and flood management.

¹ The CFRP, launched in 2023, is funded under the National Research Foundation's Research, Innovation and Enterprise (RIE) 2025 Plan. It comprises three components – the Centre of Excellence, Applied Research, and a Living Lab.

5 CFI Singapore has kick-started its work with **nine research projects** (*refer to Annex A for more details*) across four key areas – a) coastal science research, b) monitoring, prediction and digitalisation of the coastal environment, c) innovative engineering solutions, and d) integrated nature-based solutions. Each project will involve an expert as the principal investigator and supported by several collaborators drawn from local and foreign universities, as well as industry partners.

6 For example, a project focusing on the development of modular solutions that could enhance existing coastal protection infrastructure will involve researchers from NUS and SIT, as well as industry collaborators such as engineering consultancy Surbana Jurong. Another project, which will test the efficacy of hybrid nature-based solutions (e.g. perched beaches with seagrass, mangroves on rock revetments) for coastal protection, will include a multi-disciplinary team from three NUS research institutions – Centre for Nature-based Climate Solutions (CNCS), Tropical Marine Science Institute (TMSI) and the Technology Centre for Offshore and Marine, Singapore (TCOMS) – as well as applied knowledge institute Deltares and engineering firm Delta Marine Consultants from The Netherlands.

7 Ms Hazel Khoo, Director of PUB's Coastal Protection Department, said: "Climate change is an existential threat of our times. Singapore faces a unique confluence of challenges caused by the threat of rising sea levels and extreme weather events such as intense rainfall and storm surges. We are a low-lying island with a high population density and limited land. With many competing land uses, our coastal areas are precious to us. Our goal is to ensure our coastlines are not only well-protected but can bring multi-functional value for Singapore."

8 "CFI Singapore marks a new chapter in Singapore's journey in coastal protection and flood management. We are making a significant investment in research to gain the necessary knowledge and insights for coastal and flood resilience, develop innovative

solutions tailored to overcome our local constraints and ensure our people and infrastructure are protected well into the future."

Developing local expertise for coastal protection and flood management work

9 Protecting Singapore against sea level rise is a new challenge, which requires a strong pipeline of talent to carry out the work. CFI Singapore and its partner institutes aim to attract R&D talent, create new research jobs and train PhD students. While the goal is to promote a vibrant research ecosystem, it is also important to hone new research and engineering professionals which the industry can tap on as they expand and deepen coastal protection and flood management capabilities.

10 A range of talent and workforce development courses will be offered, which include educational pathways such as PhD and Master of Science as well as undergraduate programmes, workforce training and seminar series designed to highlight new growth areas and drive collaboration across the industry. Newly introduced programmes include NUS' graduate certificate in coastal protection and flood management² and NTU's undergraduate specialisation in coastal protection³.

² For more information, visit: <https://cde.nus.edu.sg/cee/graduate/graduate-certificate-programmes/cpfm/>

³ For more information, visit: https://www.ntu.edu.sg/cee/admissions/undergraduate/specialisation#Content_C024_Col00

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About PUB, Singapore's National Water Agency

PUB is a statutory board under the Ministry of Sustainability and the Environment (MSE). It is the national water agency, which manages Singapore's water supply, water catchment, and used water in an integrated way. From April 2020, PUB also took on the responsibility of protecting Singapore's coastline from sea-level rise as the national coastal protection agency.

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 leads and coordinates whole-of-government efforts to protect Singapore from the threat of rising seas and the holistic management of inland and coastal flood risks.

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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Editor's Note: Please use **PUB, Singapore's National Water Agency** or **National water agency PUB** in your report, and the acronym **PUB** subsequently after the first mention.

Annex A

Details of nine research projects

Coastal Science Research (2)

Focus area	Project title	Summary
To study impact of climate change on coastal processes, coastal protection structures	Development of probability distributions and extreme value analysis for storm surge levels, currents, wind waves and astronomic tides	Develop models capable of simulating extreme local wind waves and storm surge conditions, to better understand the combined risk of such events taking place concurrently.
	Hybrid physics guided and data driven attribution and uncertainty quantification of coastal extremes incorporating different sources of information	Provide detailed insights into the factors influencing extreme coastal flooding events. This will help PUB better develop risk mitigation strategies.

Monitoring, Prediction and Digitalisation of Coastal Environment (2)

Focus area	Project title	Summary
To enhance prediction systems for coastal processes, rainfall, and water run-off	Development of physics-informed data-driven storm surge and wave models	Develop advanced modelling tools that integrate data with machine learning to enable more accurate forecasting of storm surges and waves at Singapore's coastal areas.
	Enhancements of Singapore's convective rainfall prediction	Utilise new methods/technology to enhance PUB's forecasting of heavy rainfall events in Singapore.

Innovative Engineering Solutions (2)

Focus area	Project title	Summary
Develop adaptive, multi-functional and integrated solutions suitable for Singapore's coastal environment	Flexible seawall and eco-park for coastal reservoir and coastal defence systems in Singapore	Develop innovative flexible seawall systems to replace conventional methods such as bunds and breakwaters.
	Modular solutions to retrofit existing coastal protection structures with impervious interlocking features which reduce seawater seepage	Develop modular watertight units that can be easily added to enhance existing coastal protection structures against sea level rise.

Integrated Nature-based Solutions (3)

Focus area	Project title	Summary
Develop novel hybrid solutions, innovative approaches to implementation, as well as planning and engineering guidelines	Shore protection with integrated nature-based solutions (Meta)	Study how different combinations of nature-based and engineering solutions work together to protect coastlines and generate a map with potential integration sites for hybrid solutions.
	Shore protection with integrated nature-based solutions (Hydro)	Advance knowledge on hybrid coastal protection solutions and test them for effectiveness in coastal protection. Examples include perched beaches with seagrasses and mangroves fronting a seawall.
	Shore protection with integrated nature-based solutions (Eco)	Determine suitable conditions for mangroves, seagrasses, corals, and macroalgae to grow in hybrid configurations and their survival under various climate change scenarios.

GROWING THE LOCAL R&D ECOSYSTEM

The Coastal Protection and Flood Management Research Programme (CFRP) – Singapore's first research programme dedicated to strengthening our coastal protection and inland flood management capabilities – was launched in 2023. To serve our mission in the long term, the CFRP aims to drive the development and application of smart solutions, as well as grow a vibrant research and development ecosystem for flood resilience locally.



OVERVIEW OF THE CFRP FRAMEWORK



H1*: Coastal Science Research

V1*

Innovative Engineering Solutions for CP & FM



V2*

Integrated Nature-based Solutions for CP



V3

Sustainable Infrastructure Solutions for CP & FM



V4

Smart Management Solutions for CP & FM



H2*: Monitoring, Prediction and Digitalisation of the Coastal Environment



H3: Integrated and Adaptive Planning

CP = Coastal Protection | FM = Flood Management | *Under CFI Singapore's scope

Under the CFRP framework, a Centre of Excellence, named Coastal Protection and Flood Resilience Institute Singapore (CFI Singapore), will oversee coastal science research and the monitoring, prediction and digitalisation of the coastal environment, so as to deliver innovative engineering and integrated nature-based solutions.

In tandem with CFI Singapore, two other components – Applied Research and Living Lab – will drive sustainable infrastructure and smart management solutions, as well as integrated and adaptive planning across the research and industry community.

