



# HARMONISING ENGINEERING SOLUTIONS WITH NATURE

## Project V2-P4

### Principal Investigator: Professor Karina Gin

National University of Singapore,  
Department of Civil and  
Environmental Engineering,  
College of Design and Engineering



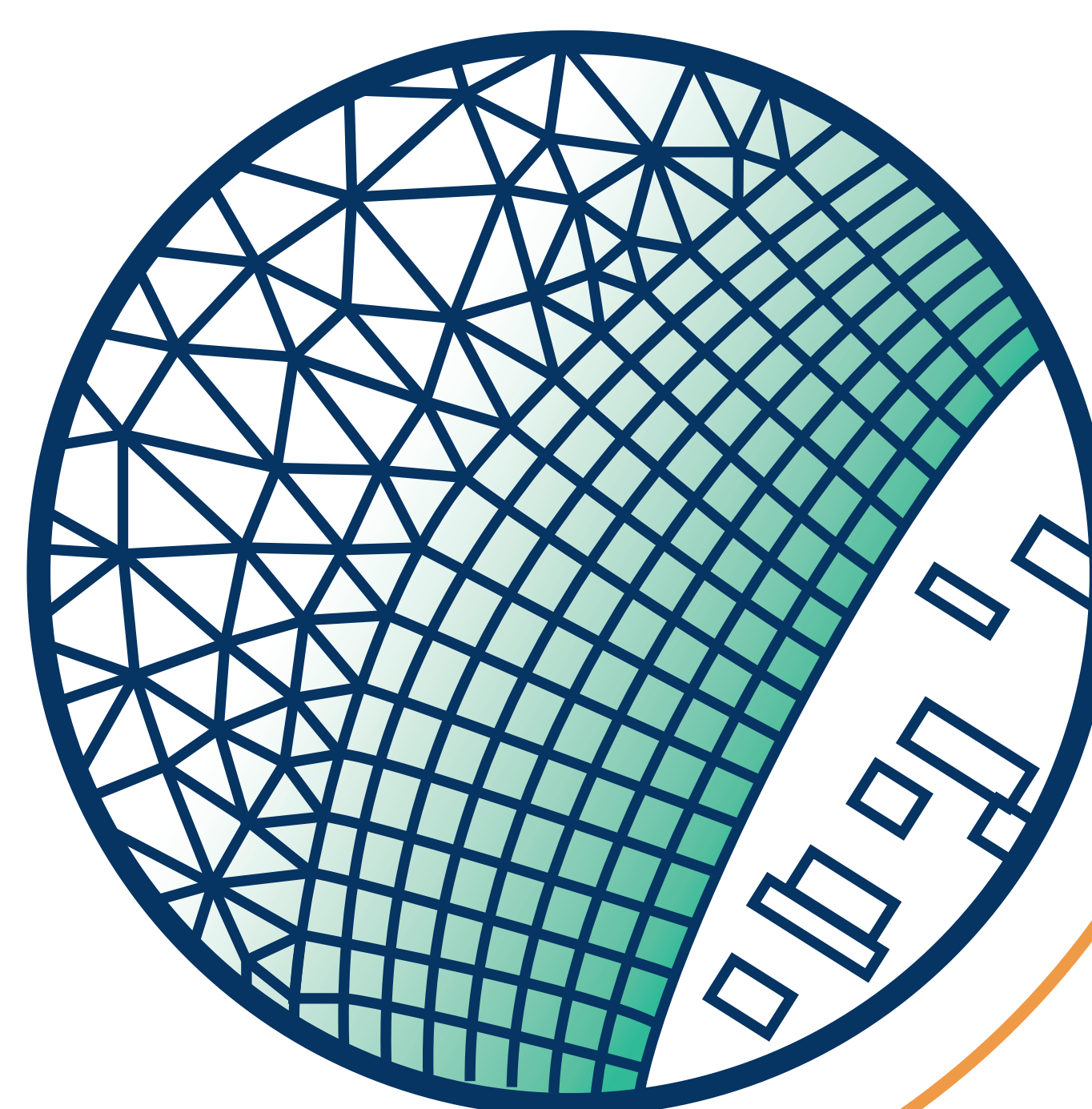
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An Integrated Coastal Ecosystem Model (ICEM) to assess the environmental impacts of anthropogenic activities and climate change on hybrid solutions

Algae growth, water quality changes and human activities can weaken mangroves and seagrass, reducing their capacity to protect coastlines. This project develops an Integrated Coastal Ecosystem Model (ICEM) combining environmental monitoring with hydrodynamic and ecological modelling to assess how these stressors affect coastal habitats. The model guides the design of hybrid coastal protection, strengthening Singapore's resilience under climate change.

## Progress

- 1 Completed comprehensive environmental and water quality monitoring to establish baseline conditions for coastal ecosystem health.
- 2 Deployed the Delft3D FM modelling suite to simulate how water quality, hydrodynamics and climate stressors affect mangrove and seagrass health.



## Outputs

- 1 A calibrated coastal ecosystem model for simulating future climate and development scenarios.
- 2 Identification of environmental conditions needed for effective nature-based coastal defences.
- 3 Science-based guidance for the design and siting of hybrid protection solutions.

## Impact

- 1 Improved planning of hybrid defences combining engineered structures with healthy coastal ecosystems.
- 2 Support for mangrove and seagrass restoration where habitats are most viable.
- 3 Evidence-based coastal adaptation and risk modelling for future shoreline protection.
- 4 Alignment with Singapore's Coastal and Flood Protection Strategy, Green Plan 2030 and City in Nature vision.

