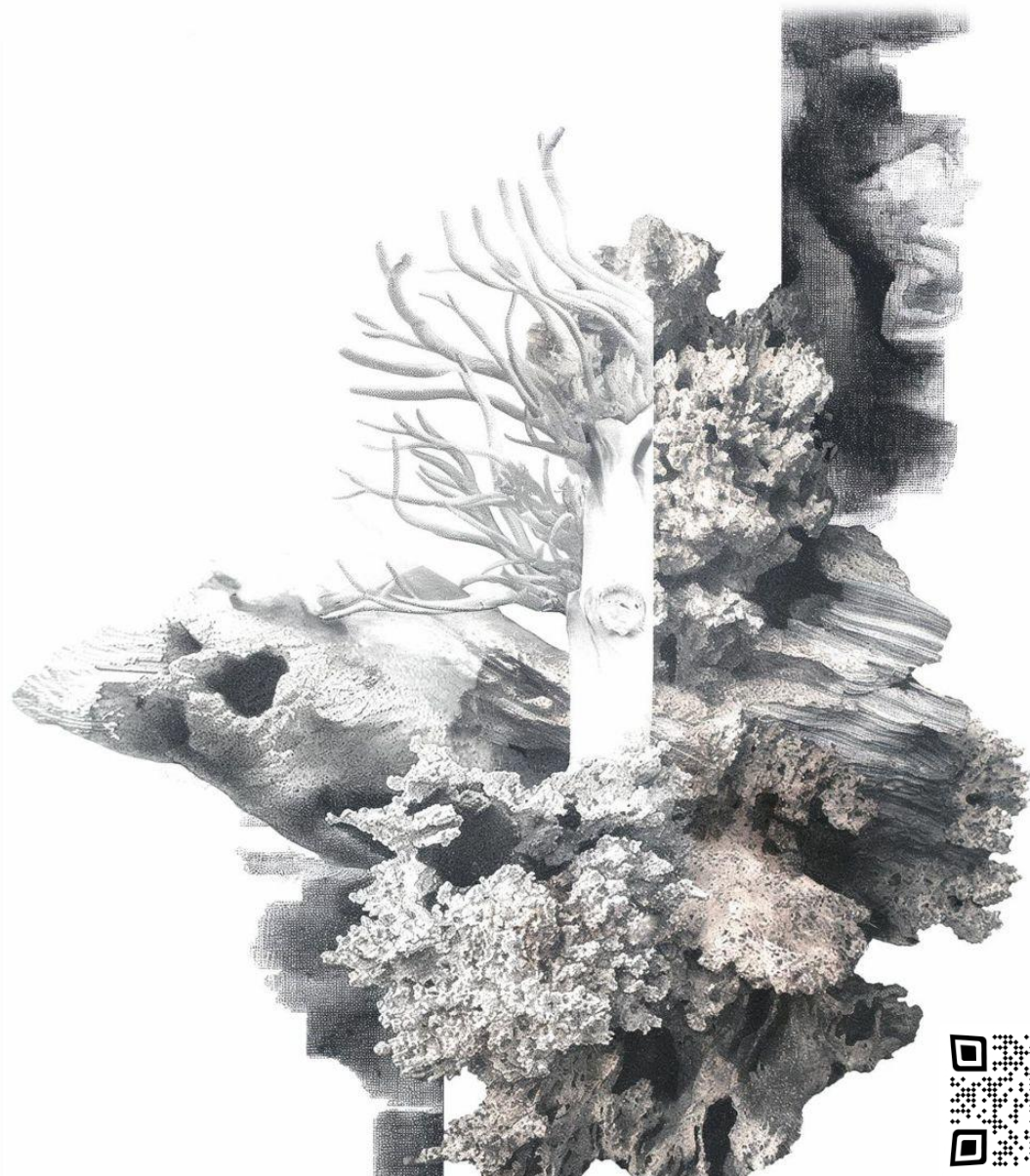


Land-Water Interface

A design proposal for wave buffering, ecological conservation, and ecotourism

Team Terra | Mr. Ambrose Yuen (HKU | LICA) / Mr. Billy Siu (S.K.H. St. Simon's Lui Ming Choi Secondary School)

Mentorship | Dr. Ng Provides



Do you know where are these corals from?



© AFCD
Photo: AFCD



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Our analysis reveals an alarming figure – over 25% of the assessed species are now facing a moderate or high risk of local extinction. Animals which are dependent on lowland habitats, such as wetland birds and freshwater fishes, are particularly at risk. This study highlights that the protection, restoration and sustainable management of lowland habitats are of the utmost importance and urgency for conservation of Hong Kong's biodiversity.

At this rate, these will likely happen in Hong Kong in a foreseeable future...

Statistics

Source: <https://www.wwf.org.hk/en/biodiversity/hkbiodiversity2025/>

Future Prediction



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Death Coral Domain

Brown Jelly Disease, BJD



Photograph: the Ocean Agency

Photograph: The Washington Post

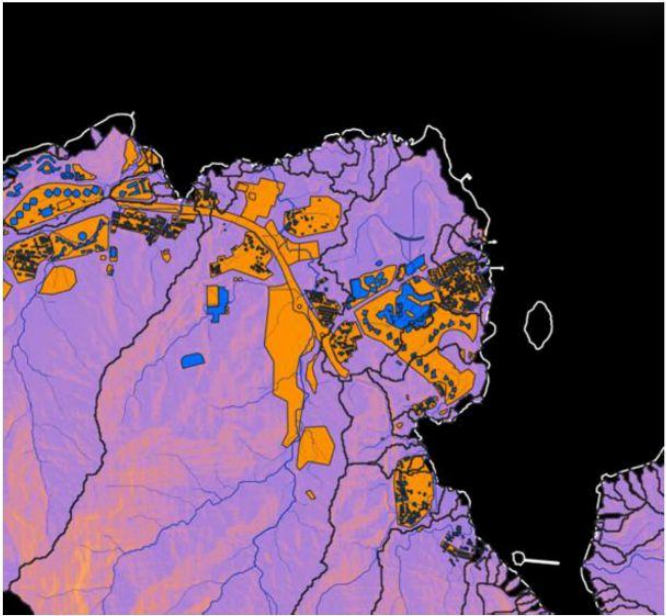
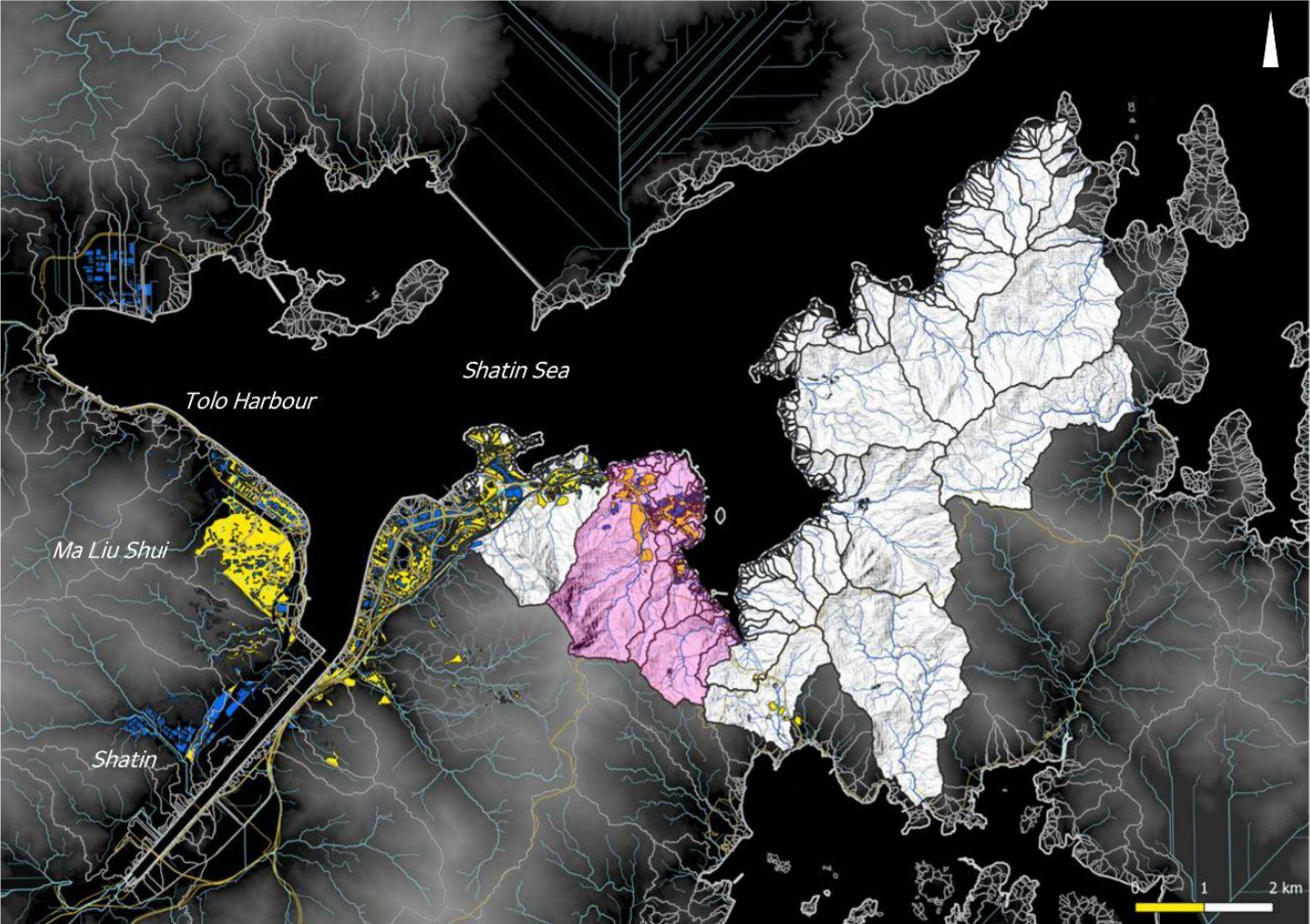
Photograph: AFP



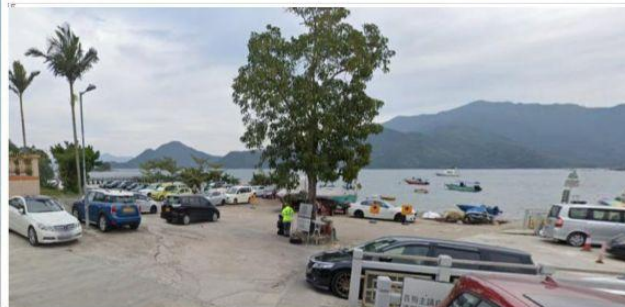
Site selection + mapping



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Site selection + mapping



Project location: the coast near Saisha GoPark Aqua and Jingtou Village.

Site characteristics: very close to sea level, located at the land-water interface, with houses along the coast, and easily affected by typhoons and strong waves.

Local fieldwork: interacted with and interviewed permanent residents in Jingtou Village.

Interview locations: within the Jingtou Village area / 357 Café / the seaside leisure park.

Findings: flooding mainly occurs along the seashore and around the edge of the village, especially during high tide, heavy rain, or typhoons. Due to building constraints, some houses were built lower than others, making them more vulnerable to seawater backflow and strong waves. The parking area near the seafront is also under threat and should be given stronger protection measures.

Because of climate change, stronger waves, and increased rainfall over the past decade, the village's drainage and flood-control facilities are generally well maintained. However, the first two rows of houses and the nearby low-lying coastal areas are still prone to flooding.



Existing Problems



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Biodiversity:

While Hong Kong is a highly urbanized metropolis, it harbors surprisingly rich biodiversity due to its varied landscapes, including mountains, woodlands, wetlands, and coastal areas. However, this biodiversity is indeed under increasing threat and showing signs of decline.

Monotonous Green Tourism location:

Most the Green Tourism landscapes of Hong Kong are being on-ground, people will soon lose interests over Hong Kong Green Tourism.

Water Intrusion:

The coastal villagers of Saisha (井頭村)—likely located in a low-lying area near the shoreline—are experiencing water intrusion, which typically refers to the unwanted ingress of seawater or brackish water into their land, wells, or even homes.



Statistic – Solution Over Biodiversity Issue



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SPRINGER NATURE Link

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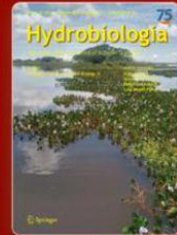
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HABITAT COMPLEXITY | Editorial Review | Published: 21 December 2011
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[Katya E. Kovalenko](#) ✉, [Sidinei M. Thomaz](#) & [Danielle M. Warfe](#)

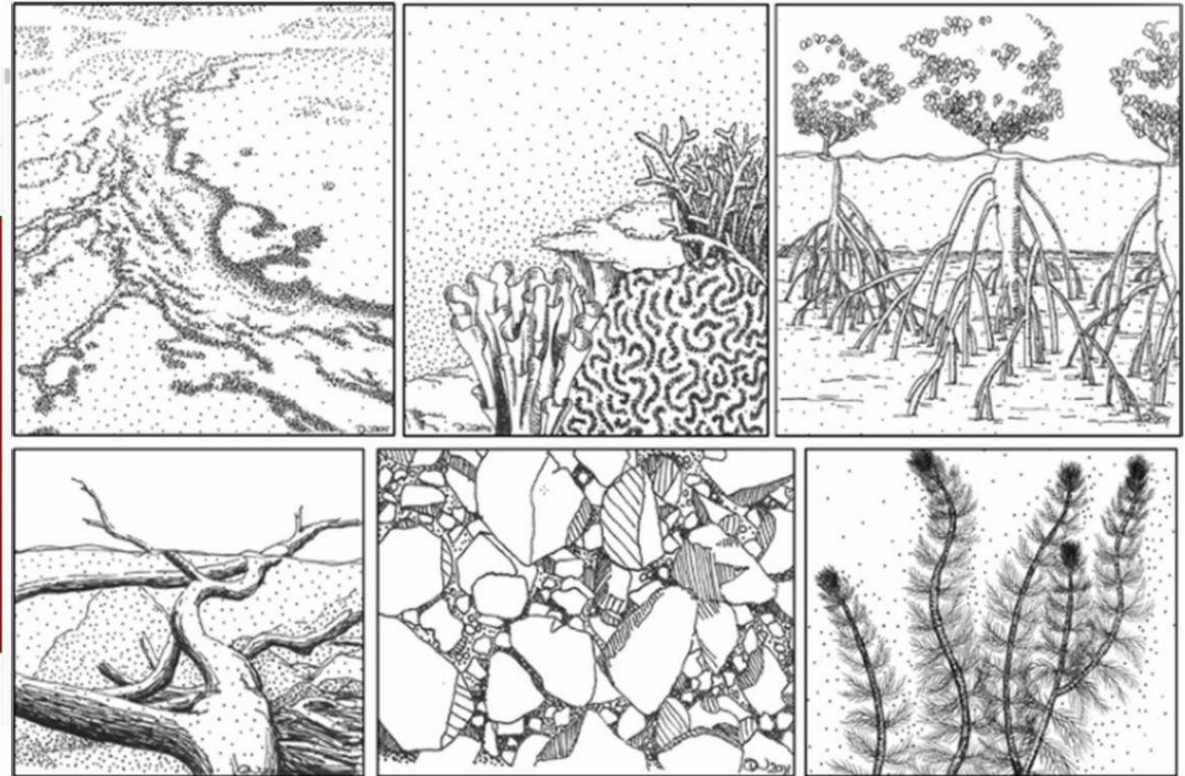


Photo credit: Ambrose and Billy



Our objectives are to

- Establish a wave buffer zone
- Restore shallow-water biological habitats
- Build a landscape for Hong Kong Green Tourism





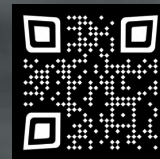
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Location: Hong Kong East Coast, Sai Kung

Our expectation for our design:

From first person diving experience, we reimagine the future of hard shoreline engineering with more nature-based solutions that can create microhabitats for intertidal ecology, while balancing eco-tourism sustainability.



Bio-Inspirations



Corals

Taking inspiration from corals, the design maximizes surface area by including pores and cavities of different sizes. These features offer protective shelters for larvae and juvenile marine organisms, while also enabling marine life to inhabit the structure from multiple angles



Orchids & Pangolin

The bionic device's structure and layout are inspired by orchid petals and pangolin's scales, which increase its surface area-to-volume ratio for efficient resource use. This provides more attachment space for marine life as their habitat, while also achieving wave attenuation and reducing onshore wave surge.





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Key Differences between Nature-based Solutions and Engineered Solutions



NbS offer a range of environmental and social co-benefits, enhancing ecosystem and community resilience. In contrast, engineered solutions primarily focus on direct emission reductions and removals.

Engineered solutions are often outperformed by nature-based solutions (NbS)—or even "doing nothing" (allowing natural recovery)—is coastal flood protection and riverbank stabilization.

Global precedents (our approach)



The Living Seawalls project, developed by the Sydney Institute of Marine Science (SIMS) and Reef Design Lab, is an ecological engineering initiative that uses 3D printing technology to restore marine biodiversity lost to urban development. Studies show that seawalls fitted with these panels attracted more than 115 species within 1-2 years, including algae, oysters, mussels, barnacles, and a variety of fish.

Sand Coral 3D Reef project, fish were attracted to the ecological reef modules immediately after deployment.



Photo: Coraal



Design process 1



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Pangolin Shore

The arrangement of the scales can effectively dissipate waves.

The gaps in between can also provide habitats for shell organisms, helping them reproduce and enhancing biodiversity, though the effect is limited in its physical forms.



Design process 2

Micro-habitat bio installation Puzzle Corals

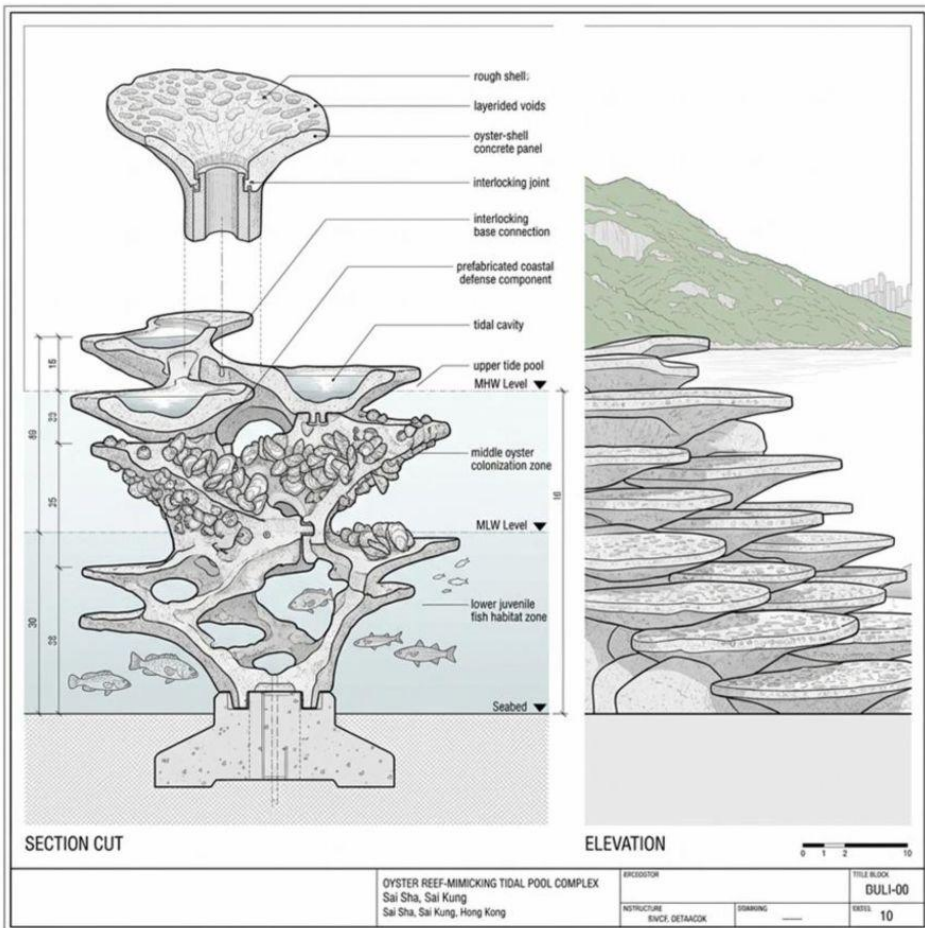
The arrangement of the scales can effectively dissipate waves. The gaps in between can also provide habitats for marine organisms, helping them reproduce and enhancing biodiversity under water. At the same time providing shading (lower water temperature) zone for newborn organisms.



Design Features



Micro-habitat bio installation Puzzle Corals



The arrangement of the scales can effectively dissipate waves. The gaps in between can also provide habitats for marine organisms, helping them reproduce and enhancing biodiversity under water. At the same time providing shading (lower water temperature) zone for newborn organisms.

Design Features

Self Repairing

While the material use, self-healing concrete, being able to self repair using embedded agents, primarily through bacterial biomineralization, chemical capsules, or vascular networks, the 'newcome marine lives' (oysters, corals, shells) leftover bones, shells, firmly clinging on the walls, can also be adhere by other marine lives, increasing the surface area of the design.

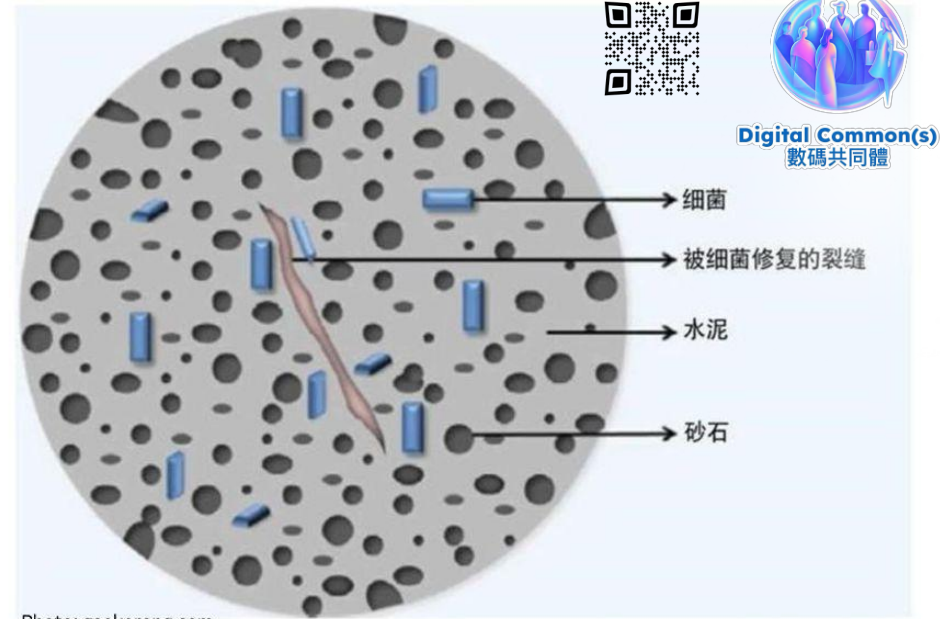


Photo: gaokerong.com

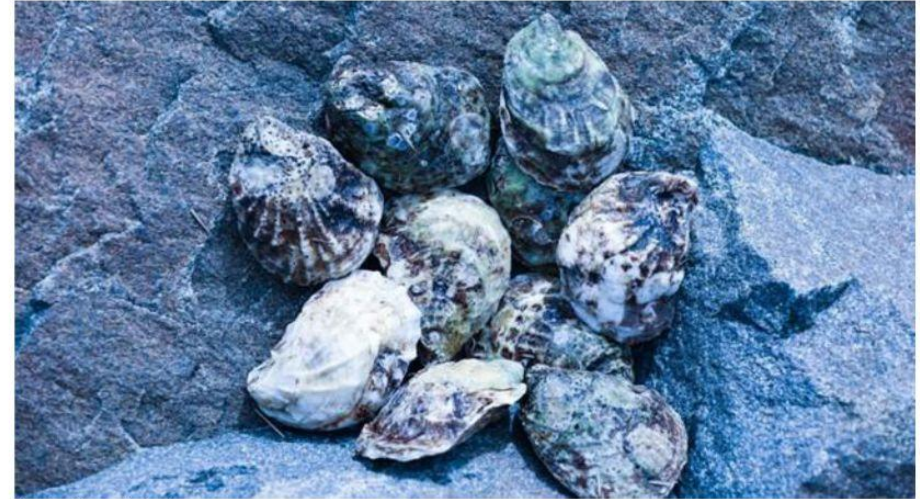


Photo: thepuristonline

Design Features

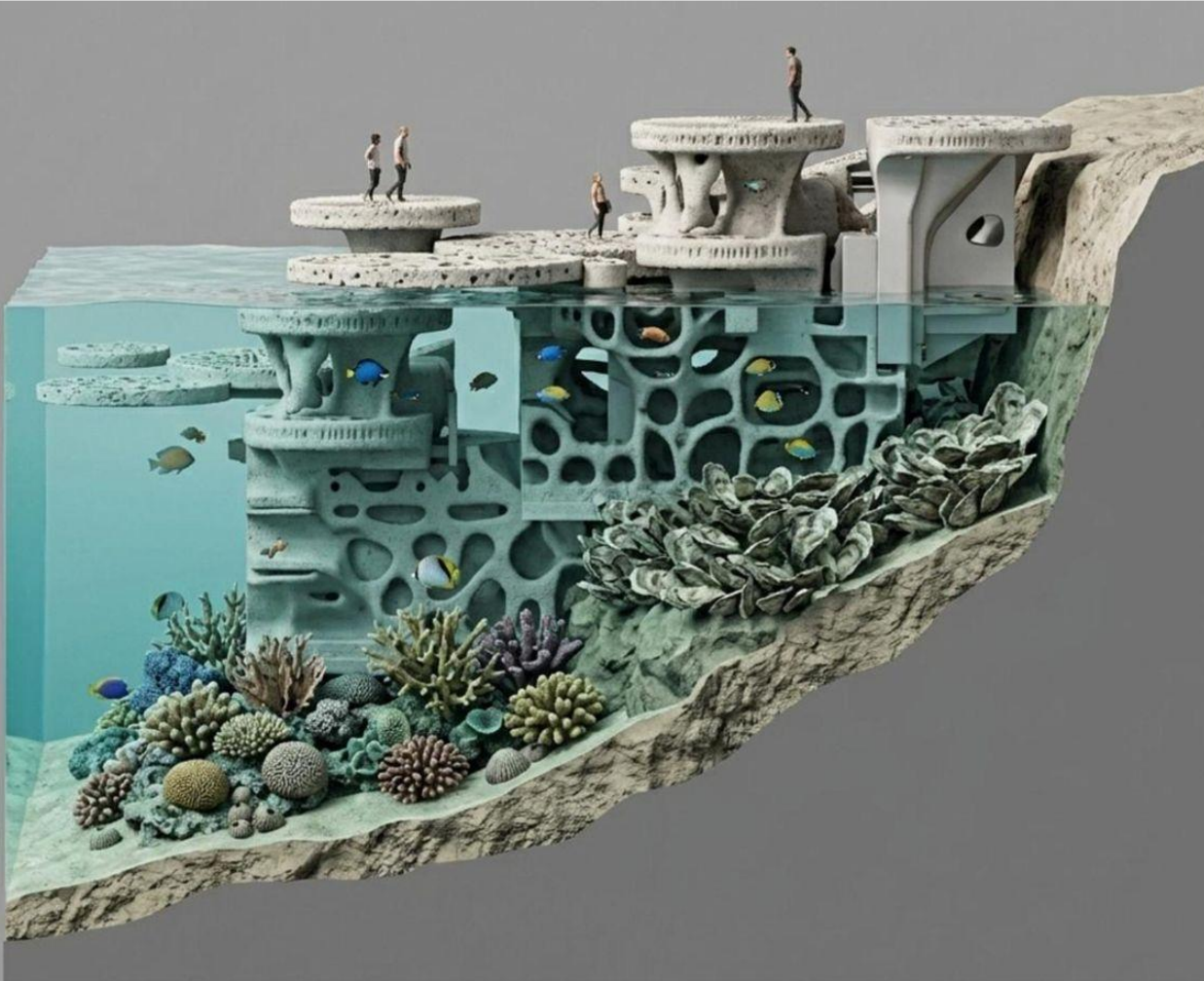


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Local Marine Ecosystem Restoration

Each component is designed as plates with many pits on the surface, therefore increasing its surface area, allowing more marine lives to occupy as their habitats, or adhering. Providing better living space for them allowing to reproduce more so the biodiversity can be increased in range.

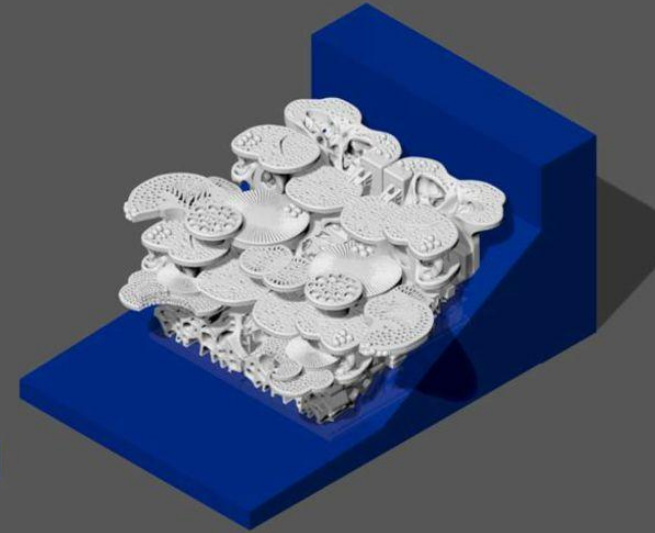
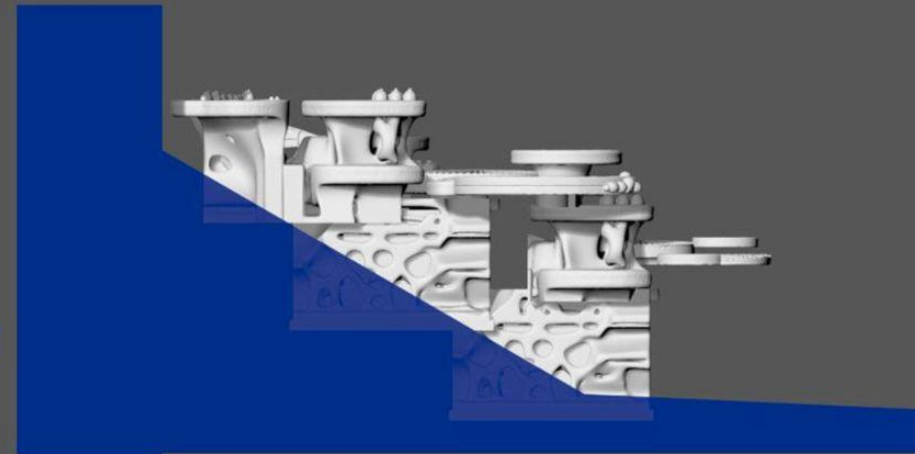
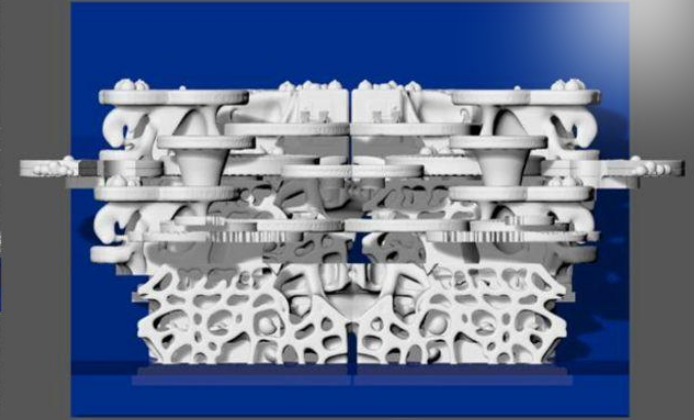
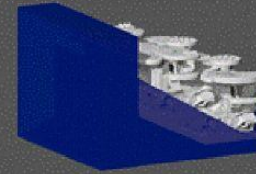
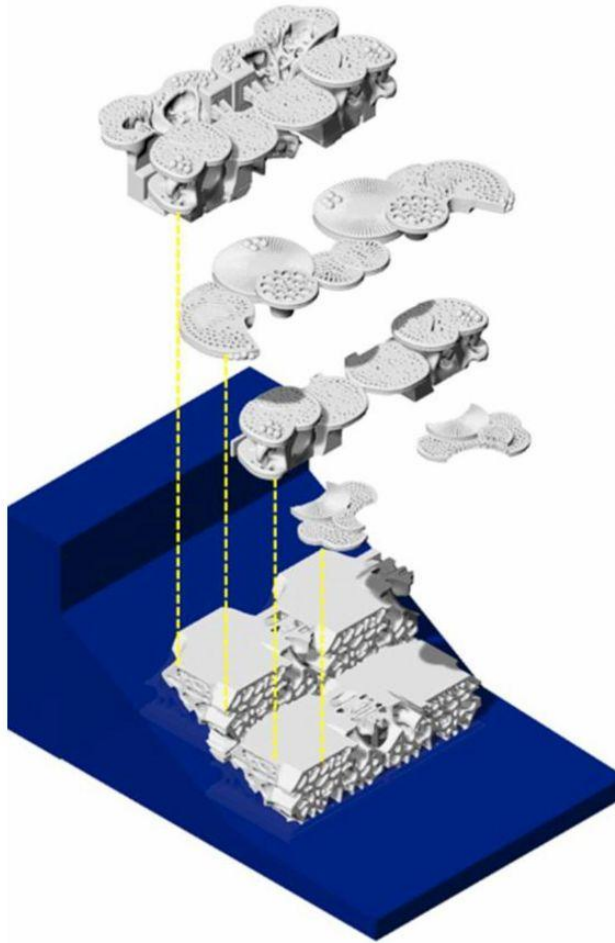
Additionally, we add more pits on the panels to make rust them.



Prototype 3D Modelling



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Eco-Tourism Starts !



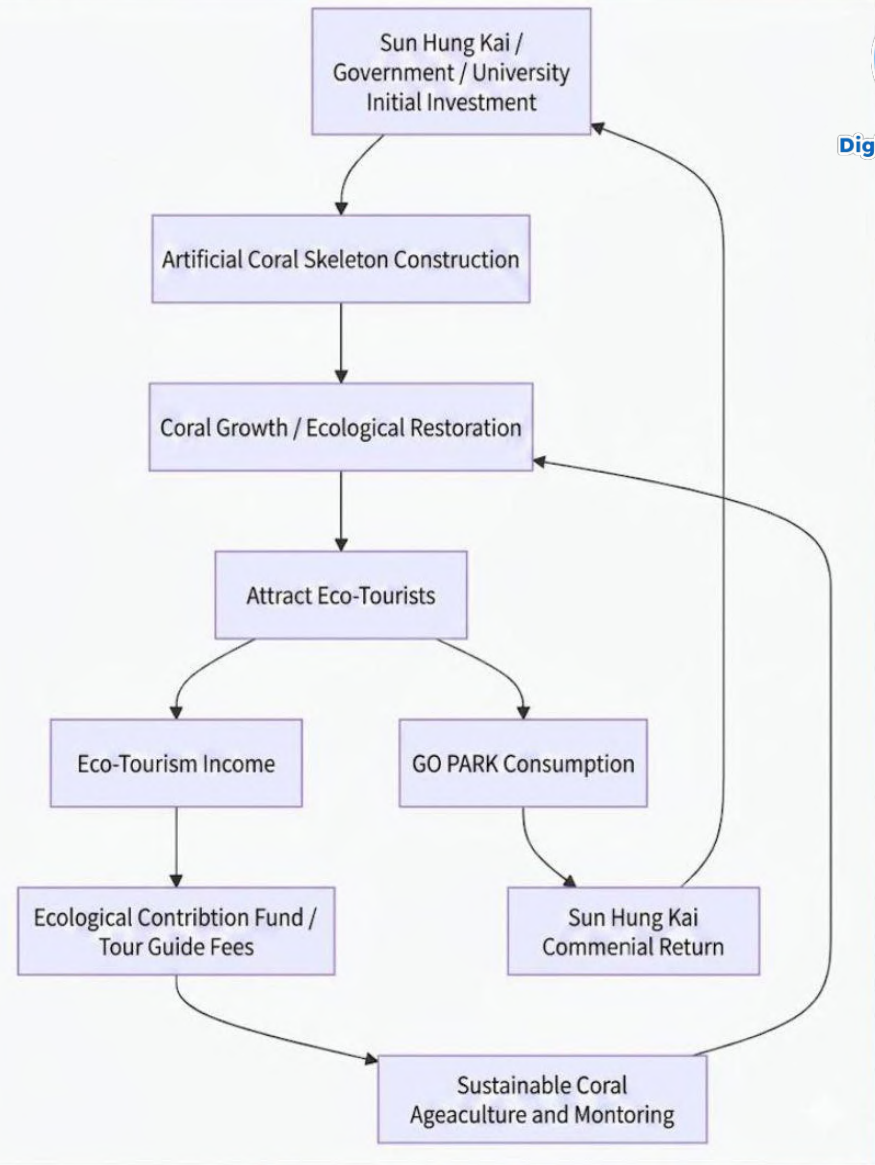
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Core concepts :

Conceptual Dimension	Specific Content
Ecological Priority	Central goal of restoring local marine ecology, ensuring the design has zero negative environmental impact.
Public Participation	Allow citizens to walk on, sit down, fish, and view the sea, transforming conservation into an experience.
Academically Driven	Collaborate with universities, using scientific research to support design and effectiveness assessment.
Commercially Sustainable	Use eco-tourism revenue to feed back into ecological restoration, forming a positive cycle.

Eco-Tourism Starts !

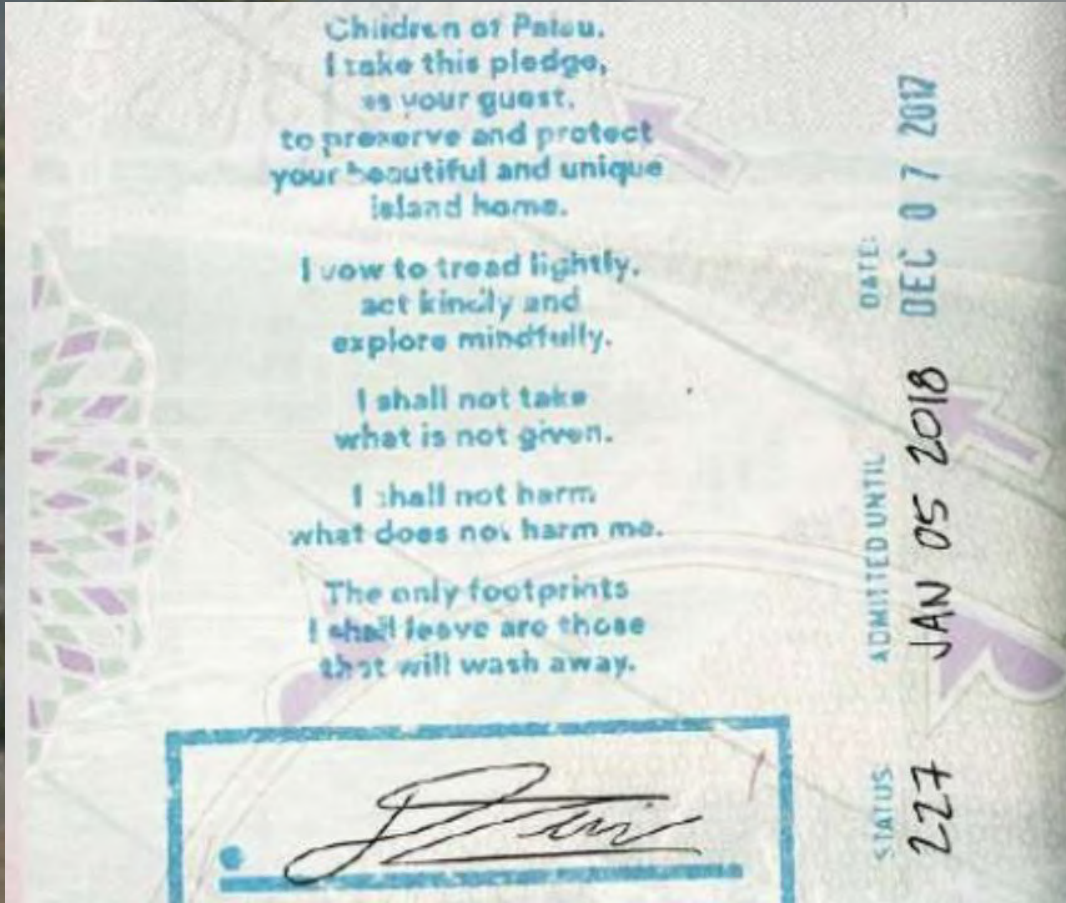
A sustainable business plan for our eco-tourism proposal:



Scenario Design & Future Speculations



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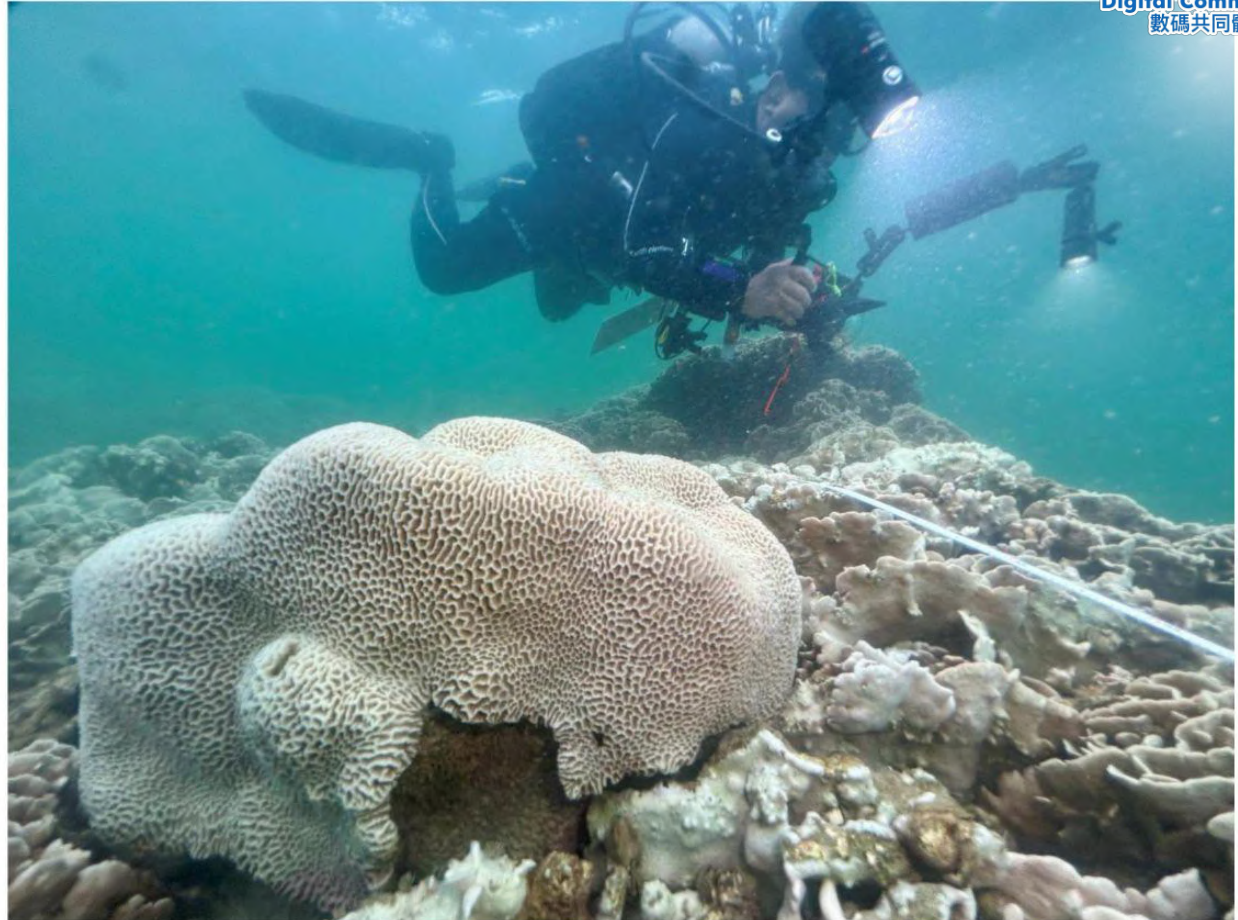


As the Budget Travel (窮游) trend took the tourism industry by storm, we also go with the flow, the Green Taxes are being lower, so the trip had been more cost-effective. Including a segment of diving and allowing tourists to take part in repairing the local marine ecosystem by planting coral reefs under guidance, the trip will attract countless tourists.

We don't wish to see more species being historic in Hong Kong, therefore, we must be alerted and look for a balance of urban living and nature conserve.



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<https://www.scmp.com/news/hong-kong/health-environment/article/3273091/hong-kong-marine-life-under-threat-scientists-warn-more-frequent-coral-bleaching>

Reflection

Learning Outcomes

Learned how to identify specific problems and implement targeted solutions to mitigate the flood damage affecting local residents. Learned how to iteratively optimize the design step by step, ultimately making it feasible and practical for real-world application.

Unsolved Issues

Whether the local public opinion will support or oppose the implementation of the design remains unclear.

Next Steps

In-depth research on the fabrication of 1:1 bio concrete design prototype by robotic 3D printing technique.



Ambrose
TSL/ Design Leader

Inspiring design and interaction experience with all mentors and participants. I've obtained so much outcomes from those young designers from diverse background!



Billy
Participant/ Designer

It truly is a novel experience getting to work with others over a designing project. I've learned to adjust the design till it's optimized and is viable, also how to express my own ideas to others via presentation.





第三屆 青年建築師計劃



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Design Scientist 2026 Incubation Program | The 3rd Annual
Program of The Citizen Architect Initiative

AI 仿生設計營 | 設計成果展

AI+ Biomimicry Design Final Showcase cum Exhibition



這項活動由 Future Ecopreneur Programme 隸屬下的 Eco-pilot Project 資助，該計畫由 香港科技園公司 和 和富社會企業組織，並由 恆生銀行 提供支援。