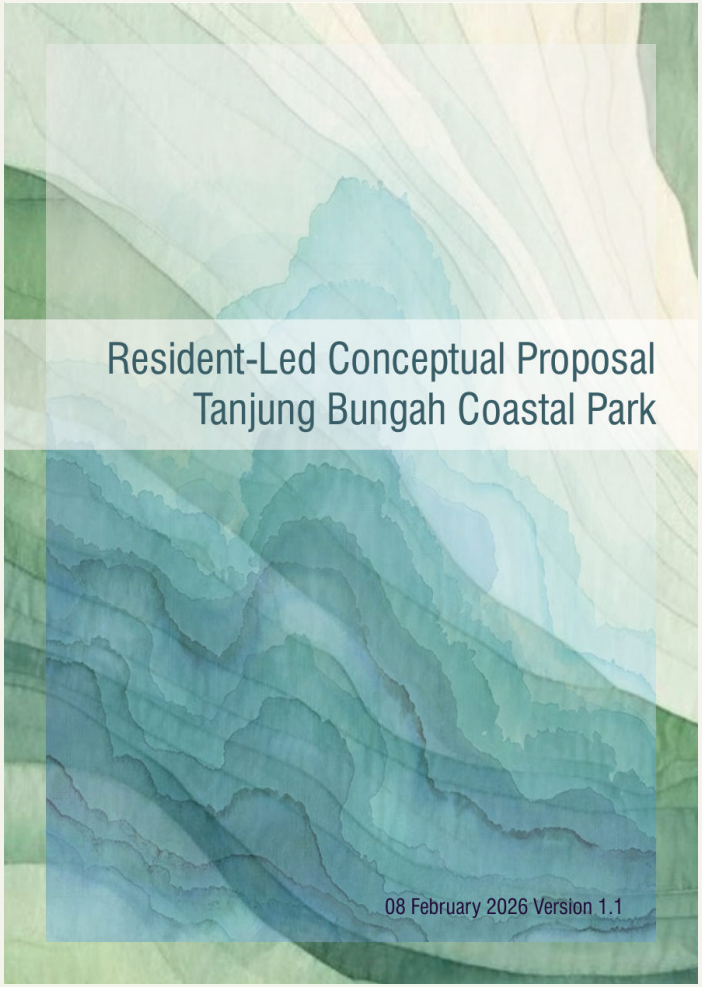


简体中文译文

完整阅读译本：按原文件页序翻译全部文字，包括图注与植物表格，并在旁边保留原图。英文版本为原始依据；本译本并非认证翻译。

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居民主导的概念建议书

丹绒武雅海岸公园

2026年2月8日 版本1.1

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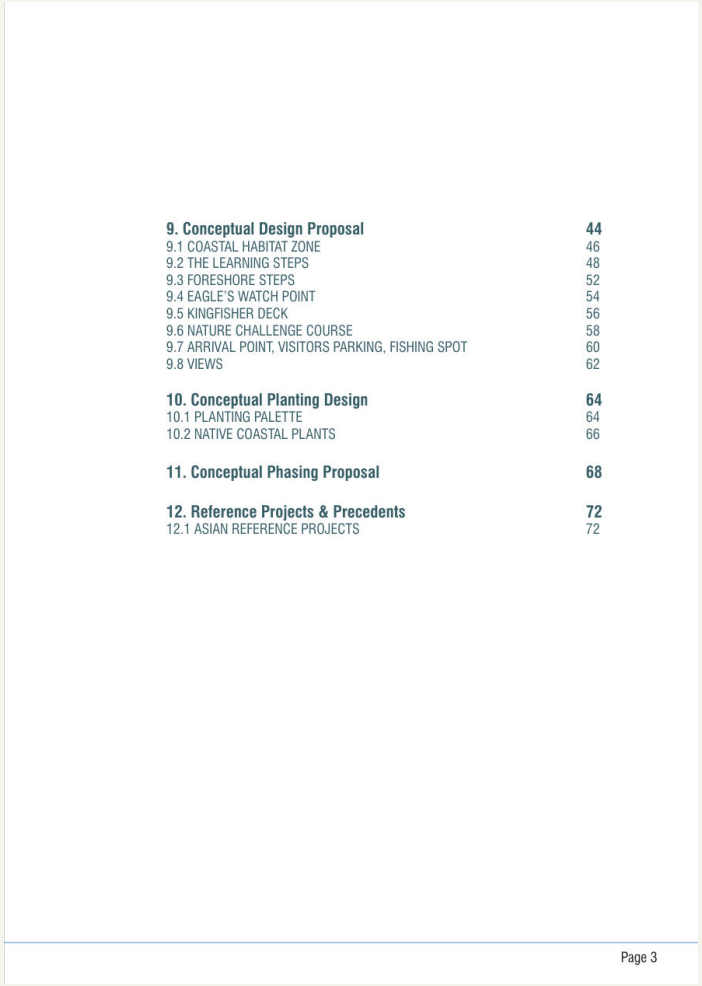
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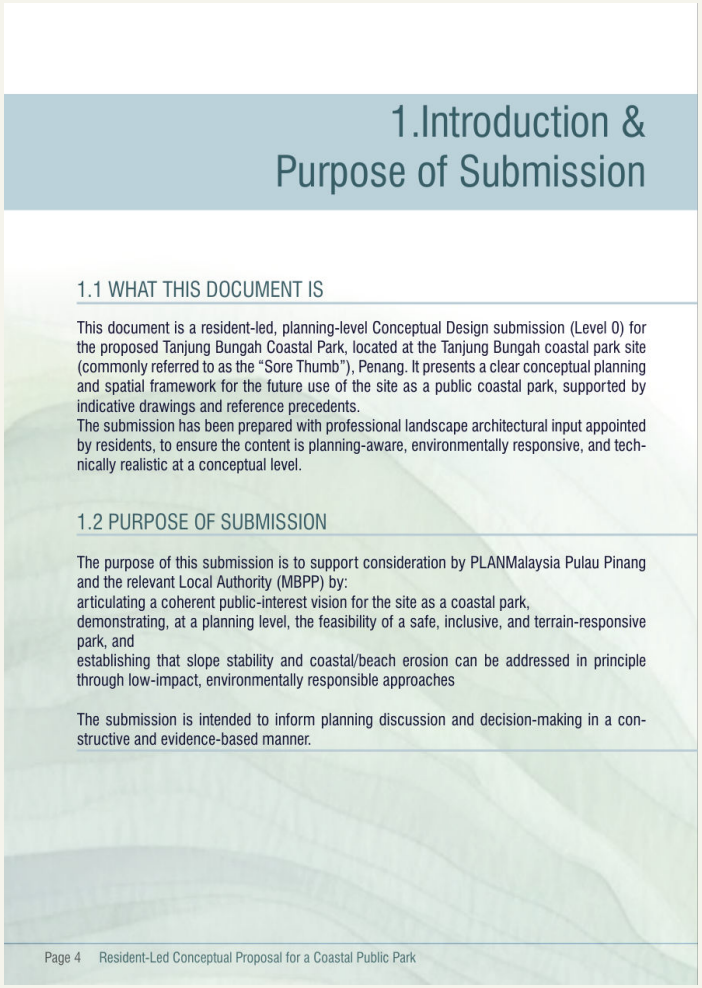
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1.Introduction &
Purpose of Submission

1.1 WHAT THIS DOCUMENT IS

This document is a resident-led, planning-level Conceptual Design submission (Level 0) for the proposed Tanjung Bungah Coastal Park, located at the Tanjung Bungah coastal park site (commonly referred to as the "Sore Thumb"), Penang. It presents a clear conceptual planning and spatial framework for the future use of the site as a public coastal park, supported by indicative drawings and reference precedents.
The submission has been prepared with professional landscape architectural input appointed by residents, to ensure the content is planning-aware, environmentally responsive, and technically realistic at a conceptual level.

1.2 PURPOSE OF SUBMISSION

The purpose of this submission is to support consideration by PLANMalaysia Pulau Pinang and the relevant Local Authority (MBPP) by:
articulating a coherent public-interest vision for the site as a coastal park,
demonstrating, at a planning level, the feasibility of a safe, inclusive, and terrain-responsive park, and
establishing that slope stability and coastal/beach erosion can be addressed in principle through low-impact, environmentally responsible approaches

The submission is intended to inform planning discussion and decision-making in a constructive and evidence-based manner.

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居民主导的公共海岸公园概念建议书

1. 引言及提交目的

1.1 本文件的性质

本文件是由居民主导、供规划层面参考的概念设计提交文件（第0级），针对位于槟城丹绒武雅海岸公园用地（俗称"Sore Thumb"）的拟议丹绒武雅海岸公园。文件提出清晰的概念性规划与空间框架，说明该地未来作为公共海岸公园的用途，并辅以示意图及参考案例。

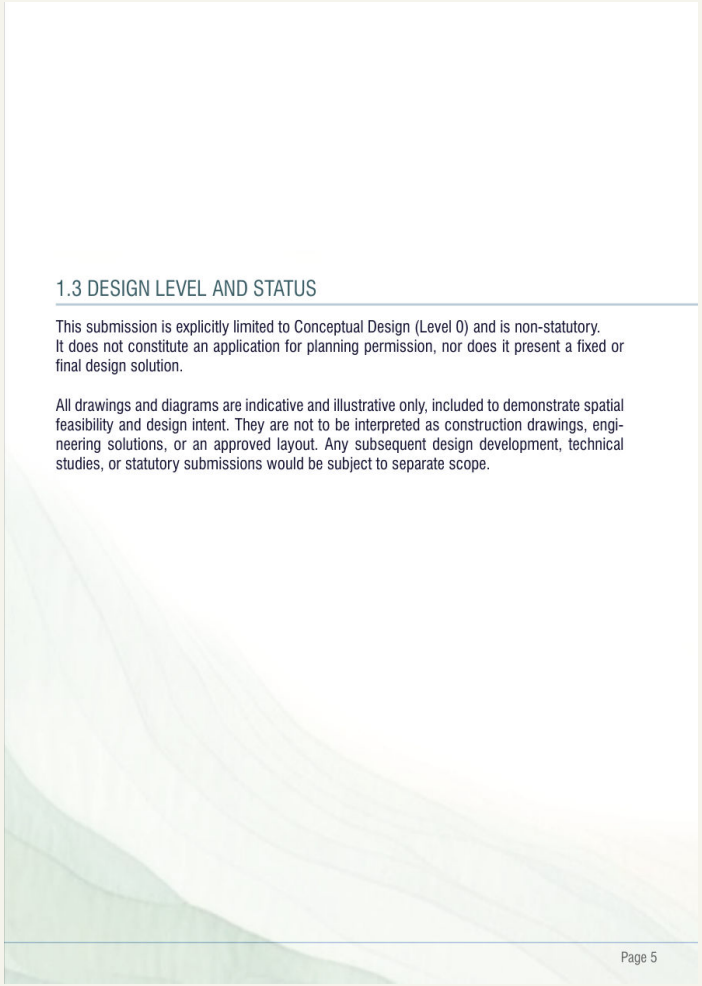
本建议书由居民委聘的专业景观建筑团队参与编制，旨在确保内容了解规划要求、回应环境条件，并在概念层面具备技术上的现实可行性。

1.2 提交目的

本建议书旨在协助槟州城乡规划局（PLANMalaysia Pulau Pinang）及相关地方政府（槟岛市政厅，MBPP）审议以下内容：

- 为该地作为海岸公园提出连贯、符合公共利益的愿景；
- 在规划层面展示建设一个安全、包容且顺应地形的公园的可行性；以及
- 确立原则上可通过低影响、对环境负责任的方法，处理边坡稳定与海岸 / 沙滩侵蚀问题。

本建议书旨在以建设性、以证据为基础的方式，为规划讨论与决策提供参考。



1.3 DESIGN LEVEL AND STATUS

This submission is explicitly limited to Conceptual Design (Level 0) and is non-statutory. It does not constitute an application for planning permission, nor does it present a fixed or final design solution.

All drawings and diagrams are indicative and illustrative only, included to demonstrate spatial feasibility and design intent. They are not to be interpreted as construction drawings, engineering solutions, or an approved layout. Any subsequent design development, technical studies, or statutory submissions would be subject to separate scope.

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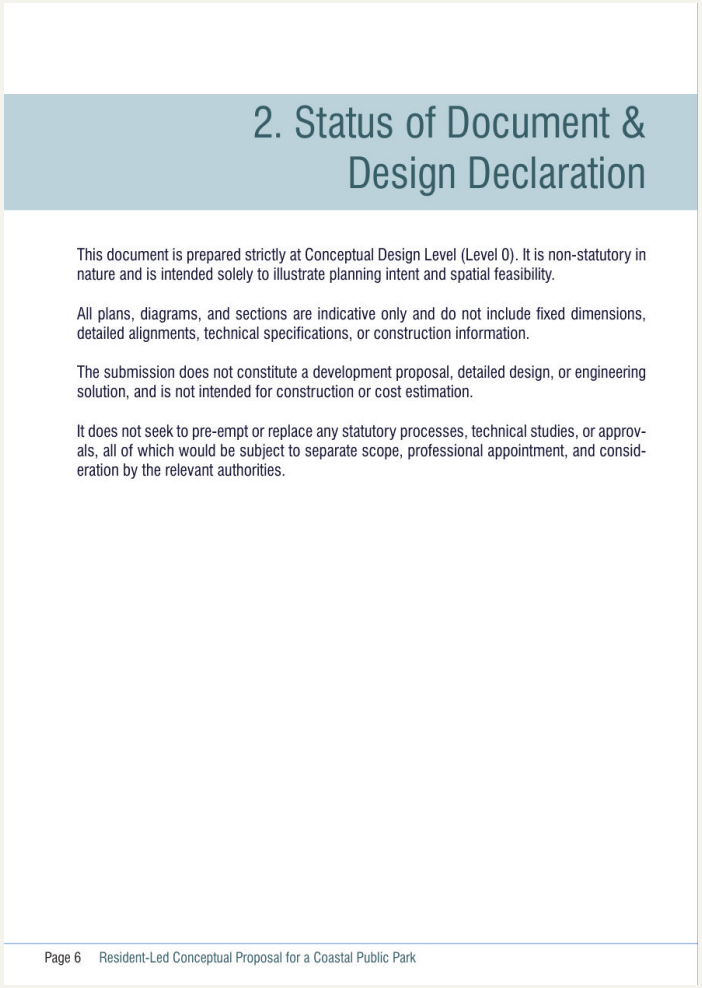
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1.3 设计层级与状态

本建议书明确仅限于概念设计（第0级），不具法定效力。它不构成规划准证申请，也不提出固定或最终的设计方案。

所有图纸及图解均仅为示意和说明用途，用以展示空间上的可行性及设计意图，不应被视为施工图、工程解决方案或获批准的布局。任何后续设计深化、技术研究或法定申请，均须另行确定工作范围。



2. Status of Document & Design Declaration

This document is prepared strictly at Conceptual Design Level (Level 0). It is non-statutory in nature and is intended solely to illustrate planning intent and spatial feasibility.

All plans, diagrams, and sections are indicative only and do not include fixed dimensions, detailed alignments, technical specifications, or construction information.

The submission does not constitute a development proposal, detailed design, or engineering solution, and is not intended for construction or cost estimation.

It does not seek to pre-empt or replace any statutory processes, technical studies, or approvals, all of which would be subject to separate scope, professional appointment, and consideration by the relevant authorities.

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居民主导的公共海岸公园概念建议书

2. 文件状态及设计声明

本文件严格按概念设计层级（第0级）编制，不具法定效力，仅用于说明规划意图及空间可行性。

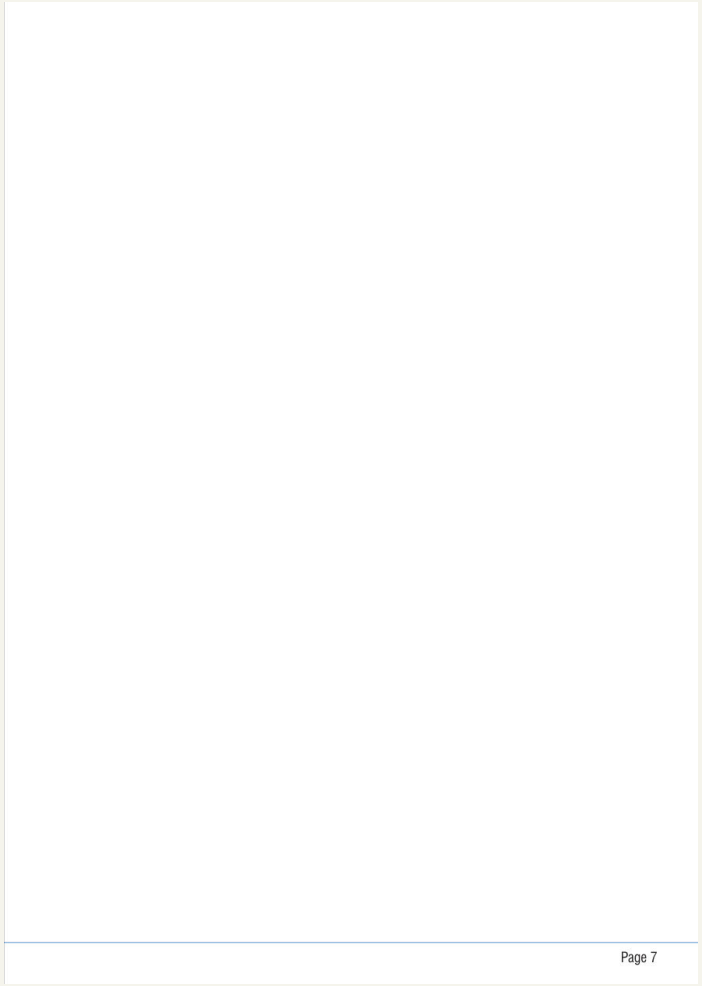
所有平面图、图解及剖面图均仅为示意，不包含确定尺寸、详细线位、技术规格或施工资料。

本建议书不构成发展方案、详细设计或工程解决方案，也不适用于施工或造价估算。

本文件无意预先决定或取代任何法定程序、技术研究或审批。这些工作均须另行确定范围、委聘专业人员，并由相关部门审议。

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3. Site Context & Understanding

3.1 OVERALL LOCATION AND CHARACTER

The Tanjung Bungah Coastal Park site, located in Tanjung Bungah (including a part commonly referred to as the "Sore Thumb"), occupies a prominent position along the northern coastline of Penang. The site directly adjoins the sea and is situated adjacent to the One Tanjung Condominium, within a predominantly residential coastal corridor characterized by strong visual and physical connections to the shoreline.

The site forms part of a continuous coastal edge where open space, coastal landscapes, and public access play an important role in the character of Tanjung Bungah. Its sloping landforms, open exposure to the sea, and uninterrupted coastal views distinguish it from surrounding built development and contribute to its identity as a transitional space between the urban fabric and the marine environment.



Photo. Tanjung Bungah Location.(2025)

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居民主导的公共海岸公园概念建议书

3. 场地背景与认识

3.1 整体位置与特征

丹绒武雅海岸公园用地位于丹绒武雅，其中一部分俗称"Sore Thumb"，在槟城北部海岸占据显著位置。场地直接毗邻大海，靠近One Tanjung公寓，位于以住宅为主的沿海地带；该地带与海岸在视觉及实际通达方面联系紧密。

该场地属于连续海岸边缘的一部分，开放空间、海岸景观及公众通行对丹绒武雅的地方特色十分重要。其倾斜地形、面海的开放环境及不受遮挡的海岸景观，使它有别于周边建筑发展，并形成城市肌理与海洋环境之间的过渡空间。

照片：丹绒武雅位置（2025年）



Photo. Sore Thumb before the trees clearing (c.a.2024)



Photo. Sore Thumb before the tees clearing(c.a.2024)

In addition, the presence of the Sore Thumb landforms has unintentionally shaped the character of the adjoining beach, creating a secluded, calm coastal pocket that is sheltered from heavy traffic and large-scale beachfront activity.

This quieter setting supports the broader character of Tanjung Bungah as a residential and community-oriented coastal area, offering a rare sense of retreat along an otherwise increasingly urbanized shoreline.

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此外，Sore Thumb的地形无意间塑造了邻近沙滩的特色，形成一处幽静、平和的海岸小天地，远离繁忙交通及大规模海滨活动。

这片较为安静的环境呼应了丹绒武雅以住宅及社区为本的沿海特色，在日益城市化的海岸线上提供了难得的静谧退隐之处。

照片：树木清除前的Sore Thumb（约2024年）

照片：树木清除前的Sore Thumb（约2024年）



Plan: Public access is currently limited and poorly signed, unintentionally gate-keeping the beach for private users — a growing concern in Penang.



Photo. Public Access seen from the street (2025)



Photo. Public Access seen from the beach (2025)



Photo. Public Access seen from the beach (2025)

Although the beach **remains publicly accessible**, its entrance is poorly defined, with no signage, unclear way-finding, and a lack of safe, formalized access such as steps or graded paths, which limits its usability and visibility.

Local residents strongly value the ability to reach and use the shoreline, particularly in a context where many beaches in Penang are becoming de facto private due to gated developments and restricted access through private land.

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居民主导的公共海岸公园概念建议书

公众通道

半私人通道

半私人通道

无法通行

照片：从街道看公众通道（2025年）

虽然沙滩仍向公众开放，但入口并不清晰，没有标识、导向不明，也缺乏阶梯或整坡步道等安全、规范的通道，限制了沙滩的可用性及可见度。

当地居民十分重视前往和使用海岸的机会，尤其是在槟城许多沙滩因围篱式发展及私人土地的通行限制，而事实上逐渐成为私人空间的背景下。

照片：从沙滩看公众通道（2025年）

照片：从沙滩看公众通道（2025年）

平面图：目前公众通道有限且标识不足，无意中使沙滩主要由私人使用者掌握；这是槟城日益受到关注的问题。



Plan. The introduction of a second public access will improve accessibility to the beach for a wider range of users.

The proposed **Coastal Park seeks to directly address these shortcomings** by clarifying and safeguarding public access to the beach.

By integrating the beach with a clearly legible public park, the project will make the shoreline easier to find, safer to access, and more enjoyable to use, while retaining its calm and intimate character.

Despite its secluded nature, the beach already serves as a shared space during national holidays, when it is actively used by both Malaysians and visitors alike—highlighting its importance as a genuinely public coastal asset worthy of protection and enhancement.

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现有公众通道

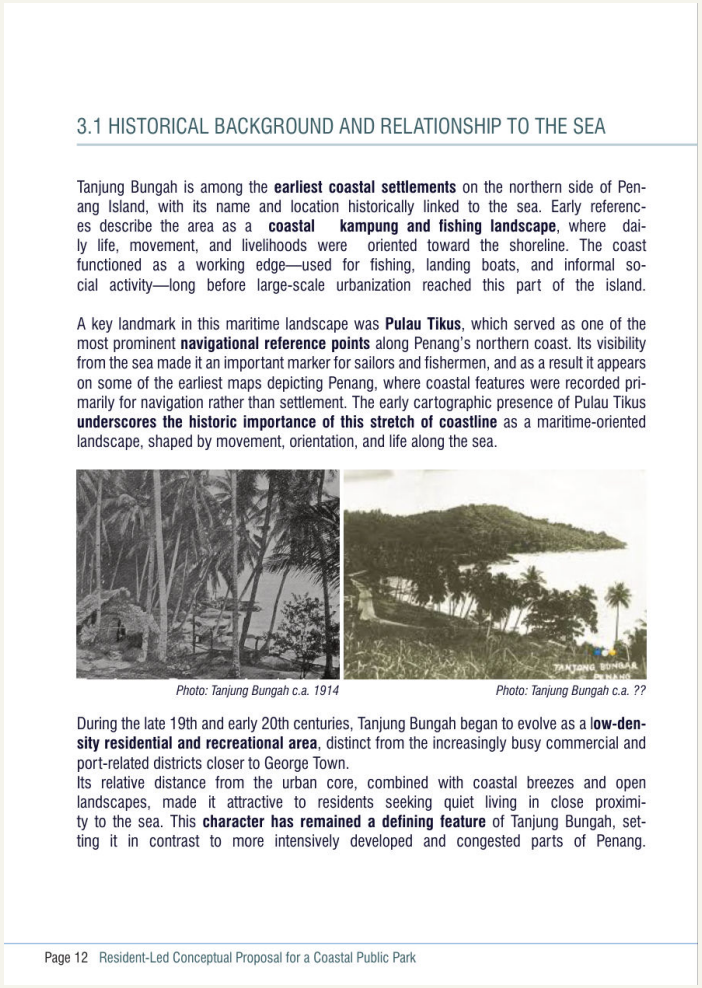
新增公众通道

拟议海岸公园旨在通过明确及保障公众通往沙滩的通道，直接解决这些不足。

将沙滩与一个布局清晰、容易辨认的公共公园结合后，项目将让海岸更容易寻找、进入更安全、使用体验更愉快，同时保留其宁静而亲切的特色。

沙滩虽然较为隐蔽，但在公共假日期间已是马来西亚民众与游客共同使用的空间，凸显其作为真正公共海岸资产的重要性，值得保护和改善。

平面图：增设第二条公众通道，将改善更多不同使用者前往沙滩的便利性。



3.1 HISTORICAL BACKGROUND AND RELATIONSHIP TO THE SEA

Tanjung Bungah is among the **earliest coastal settlements** on the northern side of Penang Island, with its name and location historically linked to the sea. Early references describe the area as a **coastal kampung and fishing landscape**, where daily life, movement, and livelihoods were oriented toward the shoreline. The coast functioned as a working edge—used for fishing, landing boats, and informal social activity—long before large-scale urbanization reached this part of the island.

A key landmark in this maritime landscape was **Pulau Tikus**, which served as one of the most prominent **navigational reference points** along Penang's northern coast. Its visibility from the sea made it an important marker for sailors and fishermen, and as a result it appears on some of the earliest maps depicting Penang, where coastal features were recorded primarily for navigation rather than settlement. The early cartographic presence of Pulau Tikus **underscores the historic importance of this stretch of coastline** as a maritime-oriented landscape, shaped by movement, orientation, and life along the sea.

Photo: Tanjung Bungah c.a. 1914 *Photo: Tanjung Bungah c.a. ??*

During the late 19th and early 20th centuries, Tanjung Bungah began to evolve as a **low-density residential and recreational area**, distinct from the increasingly busy commercial and port-related districts closer to George Town.
Its relative distance from the urban core, combined with coastal breezes and open landscapes, made it attractive to residents seeking quiet living in close proximity to the sea. This **character has remained a defining feature** of Tanjung Bungah, setting it in contrast to more intensively developed and congested parts of Penang.

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居民主导的公共海岸公园概念建议书

3.1 历史背景及与海洋的关系

丹绒武雅是槟岛北部最早的沿海聚落之一，其名称及地理位置在历史上一直与海洋紧密相连。早期记载将这里描述为沿海甘榜与渔业景观，日常生活、往来活动和生计均面向海岸。早在大规模城市化扩展至槟岛这一带之前，海岸已是生产生活的边界，用于捕鱼、船只靠岸及非正式社交活动。

这片海洋景观中的重要地标是Pulau Tikus小岛，它是槟城北部海岸最显著的航海参照点之一。由于从海上清晰可见，该岛成为水手和渔民的重要标记，也因此出现在最早描绘槟城的部分地图上；这些地图记录海岸特征，主要是为了导航而非描述聚落。Pulau Tikus早期即被绘入地图，凸显这段海岸作为面向海洋的景观所具有的历史重要性，其特色由沿海的移动、方向辨识与生活共同塑造。

19世纪末至20世纪初，丹绒武雅开始发展为低密度住宅及休闲区域，有别于乔治市附近日益繁忙的商业与港口相关地区。

这里距离城市核心相对较远，兼有海风及开阔景观，吸引希望在海边安静生活的居民。这一特色一直是丹绒武雅的重要标志，使其与槟城其他发展密集、交通拥挤的地区形成区别。

照片：丹绒武雅，约1914年

照片：丹绒武雅，约？？年



Photo: Tanjung Bungah c.a 1960

One of the earliest major formal developments in the area was the Penang Swimming Club, established in the early 20th century along the Tanjung Bungah shoreline. The club's siting directly at the water's edge reflects the long-standing recreational relationship between the community and the sea, reinforcing the area's identity as a coastal leisure environment rather than an industrial or commercial one.



Photo: Penang Swimming Club: founded in 1903

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该地区最早的大型正式建设之一，是20世纪初设于丹绒武雅海岸的槟城游泳公会（Penang Swimming Club）。公会直接临水而建，体现社区与海洋之间长期的休闲关系，强化了这里作为海岸休闲环境，而非工业或商业地区的身份。

照片：丹绒武雅，约1960年

照片：槟城游泳公会，成立于1903年

Pulau Tikus小岛

More recently, this relationship is also symbolically expressed through the Tanjung Bungah **Floating Mosque (Masjid Terapung Tanjung Bungah)**, which is deliberately positioned in close dialogue with the water. The mosque's setting reinforces the cultural and spiritual significance of the sea within the local landscape, and reflects a continued tradition of integrating built form with the coastal environment rather than separating it through hard barriers.



Photo: Masjid Terapung Tanjung Bungah by Hafiz Ismail c.a 2024



Photo: Before Masjid Terapung Tanjung Bungah

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居民主导的公共海岸公园概念建议书

近年来，丹绒武雅水上清真寺（Masjid Terapung Tanjung Bungah）也在象征层面表达了这种关系，其选址刻意与水面形成紧密对话。清真寺的环境强化了海洋在当地景观中的文化与精神意义，也体现出让建筑融入海岸环境、而非以硬质屏障将两者分隔的持续传统。

照片：丹绒武雅水上清真寺，Hafiz Ismail摄，约2024年

照片：丹绒武雅水上清真寺兴建前

The subject site itself originated from a past unauthorized **land reclamation,** which altered the original shoreline configuration. While this intervention was not formally planned, the resulting landform has since become embedded within the broader coastal fabric of Tanjung Bungah. Over time, natural coastal processes and vegetation establishment have reshaped the site, allowing it to reconnect functionally and visually with the sea. In this sense, the site reflects the layered history of Tanjung Bungah—where natural systems, informal coastal use, and later residential development have coexisted and evolved along the shoreline.



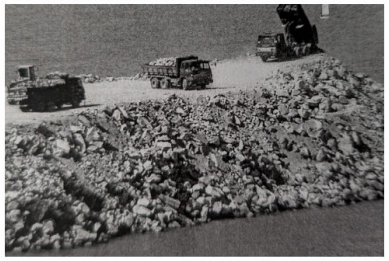


Photo: Land reclamation (alleged illegal): the extensive footprint of the "Sore Thumb" is clearly visible

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该场地本身源自过去未经批准的填海活动，改变了原有海岸线形态。虽然这一干预并非正式规划的结果，形成的地貌如今已融入丹绒武雅更广泛的海岸环境。随着时间推移，自然海岸过程与植被生长重新塑造了场地，使其在功能及视觉上重新与海洋衔接。从这个意义上说，场地反映了丹绒武雅层层积累的历史：自然系统、非正式的海岸使用及后来的住宅发展，在海岸线上共同存在并逐渐演变。

照片：填海活动（被指属非法）；“Sore Thumb”广阔的占地范围清晰可见。



3.2 ENVIRONMENTAL IMPORTANCE AND ECOLOGICAL ROLE

Despite its artificial origin, the site has evolved into a **functioning coastal ecosystem** through natural succession. Vegetation has established across the sloping landform, creating ground cover that supports surface stability and moderates erosion.

This naturalized landscape now provides **habitat and foraging opportunities** for a range of coastal and terrestrial fauna, including birds and other small animals commonly associated with shoreline environments.

Although the site is relatively new and its ecological value is modest at the island-wide scale, it plays a pivotal role in shaping local ecology, landscape identity, and environmental continuity for the Tanjung Bungah area.

The site functions as a **local ecological haven** within an increasingly urbanized coastal stretch, providing refuge, feeding grounds, and movement space for a range of coastal and terrestrial wildlife. Its position along the shoreline allows it to operate as **a local ecological corridor,** supporting continuity between land-based habitats and nearshore marine environments. This connective role is particularly important in Penang, where much of the natural coastline has already been fragmented or replaced by hard engineering.

Photo: A continuous green link supporting wildlife movement between Penang's hill forests and the shoreline.

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居民主导的公共海岸公园概念建议书

3.2 环境重要性与生态作用

虽然场地源于人工形成，但经过自然演替，已发展为具有功能的海岸生态系统。植被在倾斜地形上生长，形成地被，有助于地表稳定并减缓侵蚀。

这片自然化景观如今为多种沿海及陆生动物提供栖息地和觅食机会，包括鸟类及其他常见于海岸环境的小型动物。

尽管场地形成时间相对较短，从全岛尺度看生态价值并不算突出，但它在塑造丹绒武雅的地方生态、景观身份及环境连续性方面发挥着关键作用。

在日益城市化的沿海地带中，场地是一处地方生态庇护所，为多种沿海及陆生野生动物提供避护、觅食及移动空间。其沿岸位置使它成为地方生态廊道，维持陆地栖息地与近岸海洋环境之间的联系。槟城大部分天然海岸已被分割，或由硬质工程取代，因此这种连接作用尤其重要。

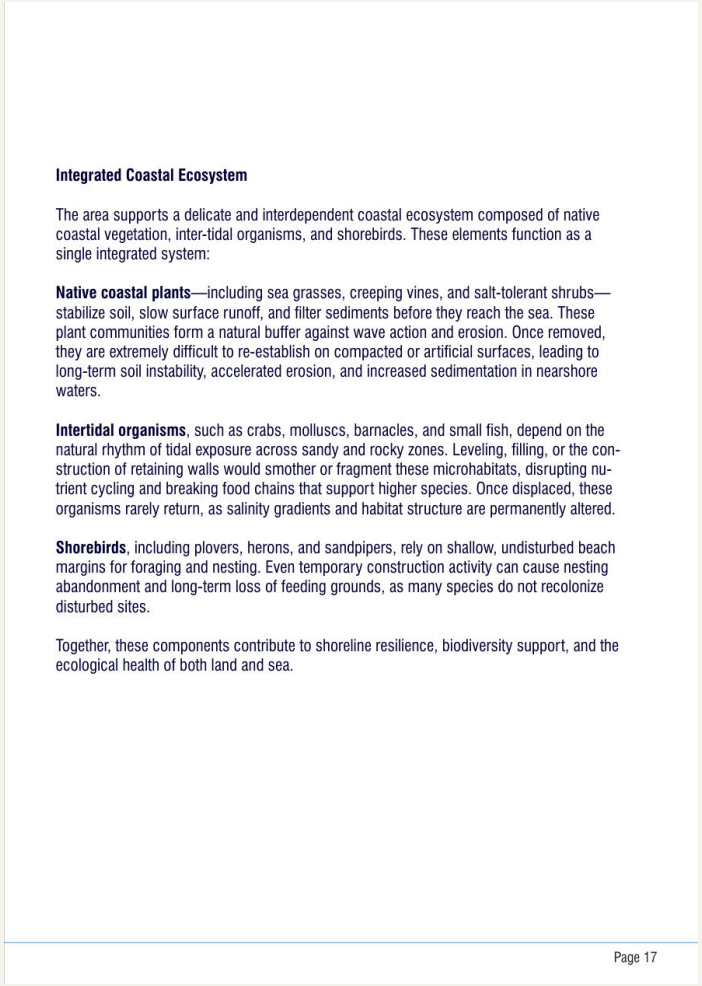
照片：连续的绿色联系，支持野生动物在槟城山地森林与海岸之间移动。

丹绒武雅海岸公园

Pulau Tikus小岛

珍珠山（Pearl Hill）

奥利维亚山（Bukit Olivia）



Integrated Coastal Ecosystem

The area supports a delicate and interdependent coastal ecosystem composed of native coastal vegetation, inter-tidal organisms, and shorebirds. These elements function as a single integrated system:

Native coastal plants—including sea grasses, creeping vines, and salt-tolerant shrubs—stabilize soil, slow surface runoff, and filter sediments before they reach the sea. These plant communities form a natural buffer against wave action and erosion. Once removed, they are extremely difficult to re-establish on compacted or artificial surfaces, leading to long-term soil instability, accelerated erosion, and increased sedimentation in nearshore waters.

Intertidal organisms, such as crabs, molluscs, barnacles, and small fish, depend on the natural rhythm of tidal exposure across sandy and rocky zones. Leveling, filling, or the construction of retaining walls would smother or fragment these microhabitats, disrupting nutrient cycling and breaking food chains that support higher species. Once displaced, these organisms rarely return, as salinity gradients and habitat structure are permanently altered.

Shorebirds, including plovers, herons, and sandpipers, rely on shallow, undisturbed beach margins for foraging and nesting. Even temporary construction activity can cause nesting abandonment and long-term loss of feeding grounds, as many species do not recolonize disturbed sites.

Together, these components contribute to shoreline resilience, biodiversity support, and the ecological health of both land and sea.

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相互融合的海岸生态系统

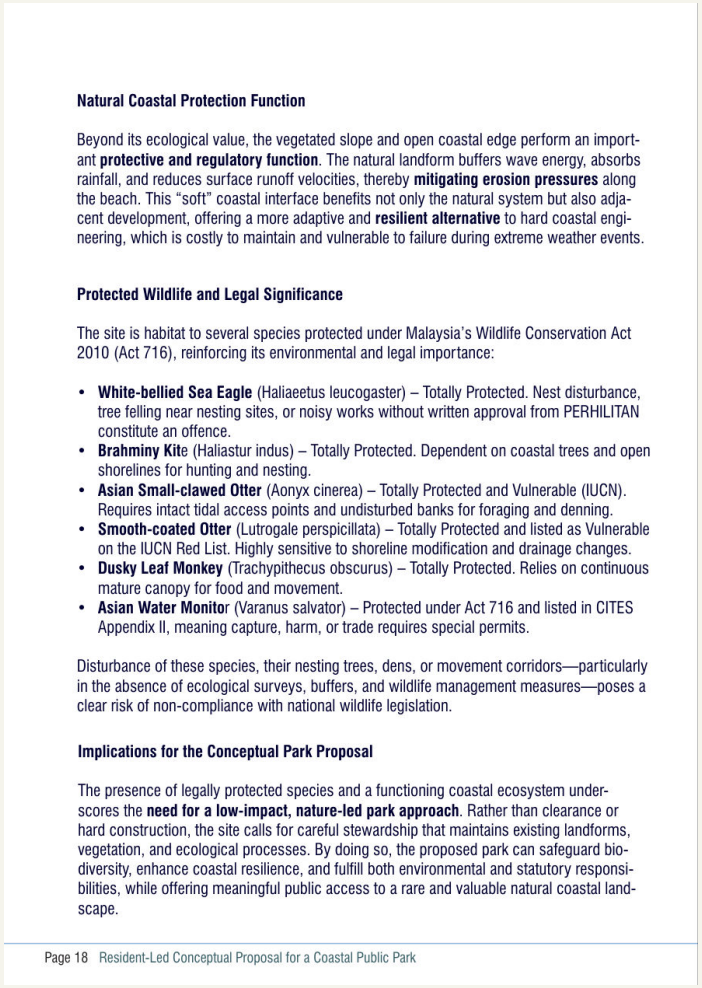
该地区维持着一个脆弱而相互依存的海岸生态系统，由本土海岸植被、潮间带生物及滨鸟组成。这些要素共同构成一个完整系统：

本土海岸植物，包括海草、匍匐藤本及耐盐灌木，可稳定土壤、减缓地表径流，并在泥沙进入海洋前将其过滤。这些植物群落形成抵御波浪作用及侵蚀的天然缓冲带。一旦移除，便极难在压实或人工表面上重新建立，导致长期土壤不稳定、侵蚀加剧，以及近岸水域泥沙沉积增加。

潮间带生物，如螃蟹、软体动物、藤壶及小鱼，依赖沙地与岩石地带随潮汐交替露出的自然节奏。整平、填土或建造挡土墙，会掩埋或分割这些微生境，扰乱养分循环，并切断维系更高营养级物种的食物链。一旦被迫迁离，这些生物往往难以返回，因为盐度梯度及栖息地结构已被永久改变。

滨鸟，包括鸻、鹭及鹬，依赖浅而未受干扰的沙滩边缘觅食及筑巢。即使是暂时的施工活动，也可能造成弃巢及长期丧失觅食地，因为许多物种不会重新回到受扰动的地点。

这些组成部分共同提升海岸韧性、支持生物多样性，并维护陆地与海洋的生态健康。



Natural Coastal Protection Function

Beyond its ecological value, the vegetated slope and open coastal edge perform an important **protective and regulatory function**. The natural landform buffers wave energy, absorbs rainfall, and reduces surface runoff velocities, thereby **mitigating erosion pressures** along the beach. This "soft" coastal interface benefits not only the natural system but also adjacent development, offering a more adaptive and **resilient alternative** to hard coastal engineering, which is costly to maintain and vulnerable to failure during extreme weather events.

Protected Wildlife and Legal Significance

The site is habitat to several species protected under Malaysia's Wildlife Conservation Act 2010 (Act 716), reinforcing its environmental and legal importance:

- **White-bellied Sea Eagle** (Haliaeetus leucogaster) – Totally Protected. Nest disturbance, tree felling near nesting sites, or noisy works without written approval from PERHILITAN constitute an offence.
- **Brahminy Kit**e (Haliastur indus) – Totally Protected. Dependent on coastal trees and open shorelines for hunting and nesting.
- **Asian Small-clawed Otter** (Aonyx cinerea) – Totally Protected and Vulnerable (IUCN). Requires intact tidal access points and undisturbed banks for foraging and denning.
- **Smooth-coated Otter** (Lutrogale perspicillata) – Totally Protected and listed as Vulnerable on the IUCN Red List. Highly sensitive to shoreline modification and drainage changes.
- **Dusky Leaf Monkey** (Trachypithecus obscurus) – Totally Protected. Relies on continuous mature canopy for food and movement.
- **Asian Water Monito**r (Varanus salvator) – Protected under Act 716 and listed in CITES Appendix II, meaning capture, harm, or trade requires special permits.

Disturbance of these species, their nesting trees, dens, or movement corridors—particularly in the absence of ecological surveys, buffers, and wildlife management measures—poses a clear risk of non-compliance with national wildlife legislation.

Implications for the Conceptual Park Proposal

The presence of legally protected species and a functioning coastal ecosystem underscores the **need for a low-impact, nature-led park approach**. Rather than clearance or hard construction, the site calls for careful stewardship that maintains existing landforms, vegetation, and ecological processes. By doing so, the proposed park can safeguard biodiversity, enhance coastal resilience, and fulfill both environmental and statutory responsibilities, while offering meaningful public access to a rare and valuable natural coastal landscape.

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居民主导的公共海岸公园概念建议书

天然海岸保护功能

除了生态价值，植被覆盖的坡面及开放海岸边缘也发挥重要的保护和调节作用。自然地形可缓冲波浪能量、吸收雨水，并降低地表径流速度，从而减轻沙滩沿线的侵蚀压力。这种"软性"海岸交界不仅有益于自然系统，也惠及相邻发展项目；相较维护成本高、在极端天气下容易失效的硬质海岸工程，它提供了更能适应变化、更有韧性的替代方案。

受保护野生动物及法律意义

场地是数种受马来西亚《2010年野生动物保护法令》（第716号法令）保护的物种的栖息地，进一步突显其环境及法律重要性：

• 白腹海雕（Haliaeetus leucogaster）——完全受保护物种。未经野生动物保护及国家公园局（PERHILITAN）书面批准而干扰巢穴、在筑巢地点附近伐树或进行嘈杂工程，构成违法行为。

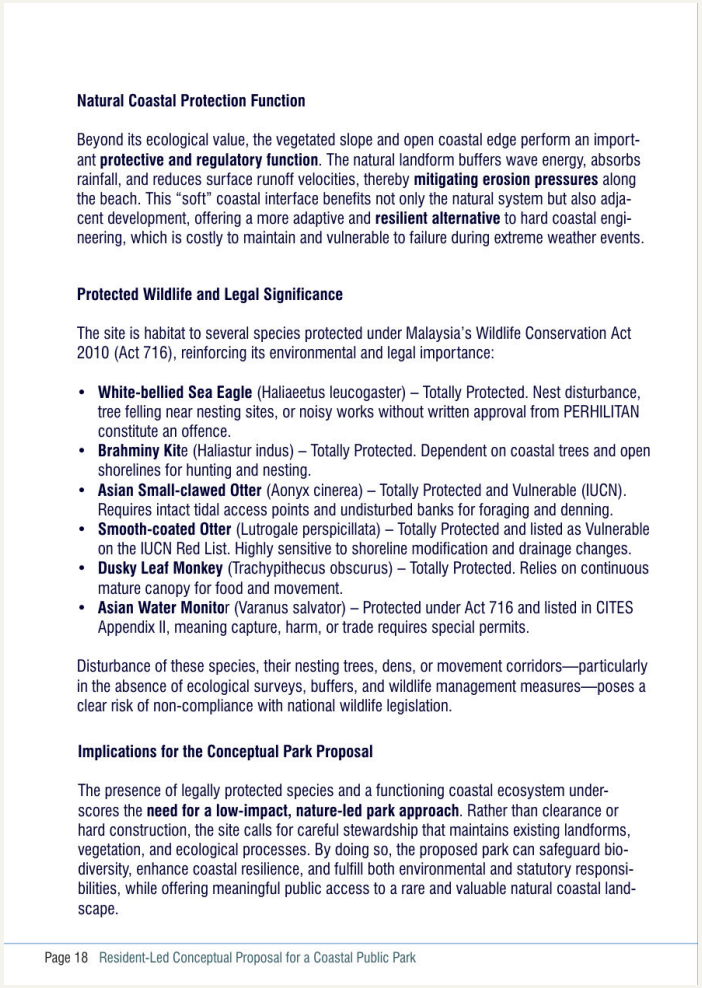
• 栗鸢（Haliastur indus）——完全受保护物种。依赖海岸树木及开放海岸线猎食和筑巢。

• 亚洲小爪水獭（Aonyx cinerea）——完全受保护物种，并被国际自然保护联盟（IUCN）列为易危。需要完整的潮汐出入口及未受干扰的岸边觅食和筑窝。

• 江獭 / 滑獭（Lutrogale perspicillata）——完全受保护物种，并列入IUCN红色名录的易危类别。对海岸改造及排水变化高度敏感。

• 暗色叶猴（Trachypithecus obscurus）——完全受保护物种。依赖连续、成熟的树冠获取食物及移动。

• 亚洲水巨蜥（Varanus salvator）——受第716号法令保护，并列于《濒危野生动植物种国际贸易公约》（CITES）附录II，捕捉、伤害或交易均须取得特别许可。



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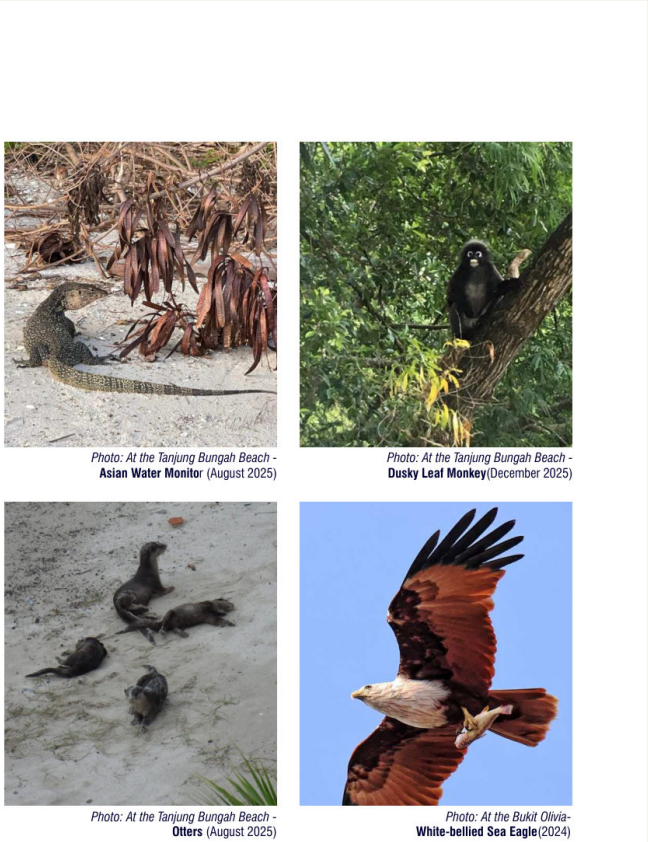
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简体中文译文 · 续

干扰这些物种、其筑巢树木、巢穴或移动廊道，特别是在缺乏生态调查、缓冲区及野生动物管理措施的情况下，会造成明显的违反国家野生动物法律的风险。

对概念公园建议的意义

场地存在依法受保护的物种及具功能的海岸生态系统，凸显采用低影响、以自然为本的公园方式的必要性。这里需要的不是清除植被或硬质建设，而是审慎管理，以保留现有地形、植被及生态过程。通过这种方式，拟议公园既可保护生物多样性、增强海岸韧性，履行环境及法定责任，又能让公众有意义地接触这一稀有而珍贵的天然海岸景观。



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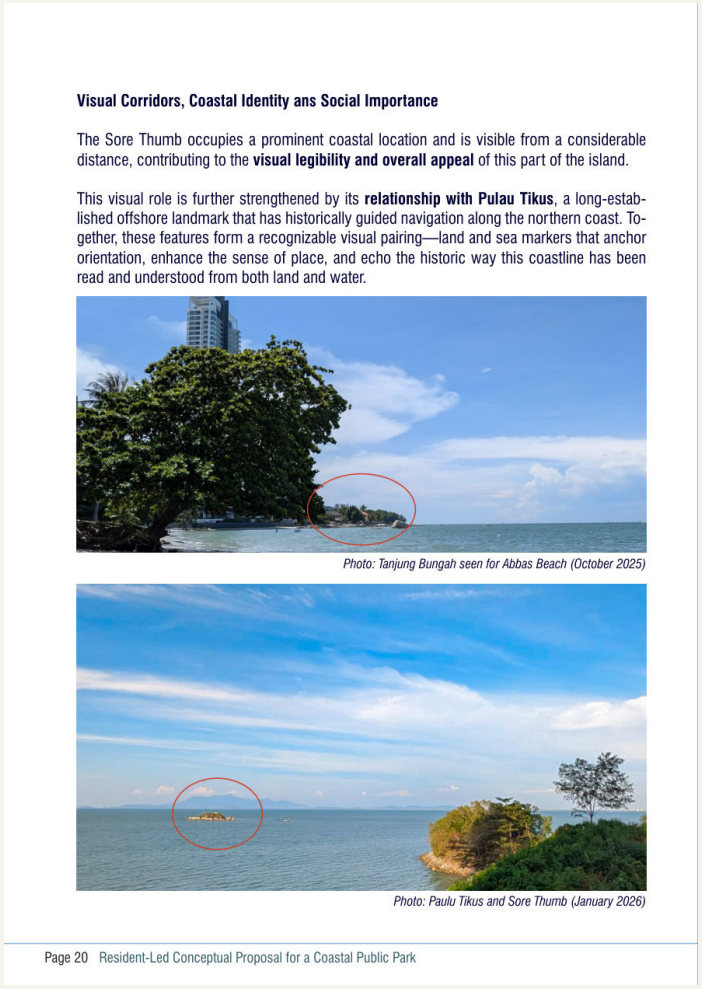
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照片：丹绒武雅沙滩——亚洲水巨蜥（2025年8月）

照片：丹绒武雅沙滩——暗色叶猴（2025年12月）

照片：丹绒武雅沙滩——水獭（2025年8月）

照片：奥利维亚山——白腹海雕（2024年）



Visual Corridors, Coastal Identity ans Social Importance

The Sore Thumb occupies a prominent coastal location and is visible from a considerable distance, contributing to the **visual legibility and overall appeal** of this part of the island.

This visual role is further strengthened by its **relationship with Pulau Tikus**, a long-established offshore landmark that has historically guided navigation along the northern coast. Together, these features form a recognizable visual pairing—land and sea markers that anchor orientation, enhance the sense of place, and echo the historic way this coastline has been read and understood from both land and water.

Photo: Tanjung Bungah seen for Abbas Beach (October 2025)

Photo: Paulu Tikus and Sore Thumb (January 2026)

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居民主导的公共海岸公园概念建议书

视线廊道、海岸身份及社会重要性

Sore Thumb位处显著的海岸位置，从相当远的距离也能看见，有助于这一带的空间辨识度及整体吸引力。它与Pulau Tikus小岛的关系进一步强化了这种视觉作用；后者是历史悠久的离岸地标，过去一直为北部海岸的航行提供指引。两者共同形成容易辨认的视觉组合：陆地与海上的标记确立方向、增强地方感，并呼应人们历来从陆地及海上辨识和理解这段海岸的方式。

照片：从Abbas Beach望向丹绒武雅（2025年10月）

照片：Pulau Tikus小岛与Sore Thumb（2026年1月）

Protecting this site directly supports the **Penang Green Agenda and Penang 2030** aspirations, which emphasize not only environmental resilience but also **social wellbeing, inclusivity, and people-centred urban development.** Public access to the coast is a vital social asset in Penang, supporting everyday recreation, informal community life, and a shared sense of place that has long defined the island's coastal settlements.

The **public protest held on the beach** after access was fenced off is a clear demonstration of this social importance. It revealed strong local concern and collective resistance to the gradual loss of public shoreline, and underscored that this space is not perceived as vacant land, but as a shared community resource. The protest was not an isolated incident, but part of a broader public response to a growing pattern of restricted coastal access across the island.



Photo: Tanjung Bungah Public Protest (1st November 2025)

Coastal protection does not always begin with large-scale projects—often **it starts with small, deliberate decisions to retain existing landscapes,** respect natural systems, and respond to public needs. This Conceptual Design is a direct, constructive response from the community to proposals that conflict with public wishes, offering an alternative that aligns environmental responsibility with social values.

Safeguarding this stretch of coast as a public, accessible natural edge therefore preserves not only ecological value and coastal resilience, but also Penang's social fabric—ensuring the shoreline remains a place where people can gather, express collective voice, and maintain an enduring relationship with the sea for generations to come.

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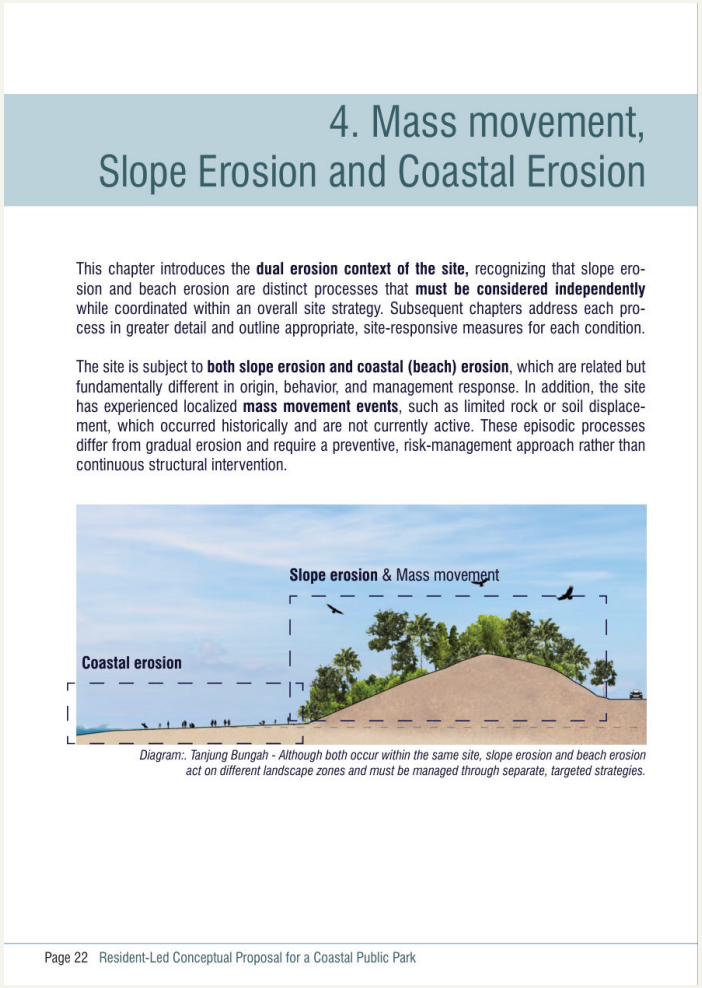
保护这片场地直接支持《槟城绿色议程》及《槟城2030》的愿景。这些愿景不仅重视环境韧性，也强调社会福祉、包容性及以人为本的城市发展。公众通往海岸的机会是槟城重要的社会资产，支持日常休闲、非正式社区生活，以及长期塑造本岛沿海聚落的共同地方认同。

沙滩入口被围封后，公众在沙滩上举行的抗议，清楚体现了这种社会重要性。行动反映当地强烈的关注，以及对公共海岸逐步流失的集体反对，并凸显这片空间在人们眼中不是闲置土地，而是共享的社区资源。这次抗议并非孤立事件，而是公众对全岛海岸通行日益受限这一趋势所作回应的一部分。

照片：丹绒武雅公众抗议（2025年11月1日）

海岸保护不一定始于大型工程；它往往从细小而审慎的决定开始：保留现有景观、尊重自然系统，并回应公众需要。本概念设计是社区针对违背民意的方案作出的直接、建设性回应，提出将环境责任与社会价值相结合的替代选择。

因此，将这段海岸保留为公共、可通达的自然边缘，不仅能维护生态价值及海岸韧性，也能维护槟城的社会纽带，确保海岸继续成为人们聚集、表达集体声音，并让世代人与海洋保持长久联系的地方。



4. Mass movement,
Slope Erosion and Coastal Erosion

This chapter introduces the **dual erosion context of the site,** recognizing that slope erosion and beach erosion are distinct processes that **must be considered independently** while coordinated within an overall site strategy. Subsequent chapters address each process in greater detail and outline appropriate, site-responsive measures for each condition.

The site is subject to **both slope erosion and coastal (beach) erosion**, which are related but fundamentally different in origin, behavior, and management response. In addition, the site has experienced localized **mass movement events**, such as limited rock or soil displacement, which occurred historically and are not currently active. These episodic processes differ from gradual erosion and require a preventive, risk-management approach rather than continuous structural intervention.

Diagram:. Tanjung Bungah - Although both occur within the same site, slope erosion and beach erosion act on different landscape zones and must be managed through separate, targeted strategies.

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居民主导的公共海岸公园概念建议书

4. 坡体移动、坡面侵蚀与海岸侵蚀

本章介绍场地面对的两类侵蚀背景，明确坡面侵蚀与沙滩侵蚀是不同过程，必须分别考虑，同时在整体场地策略中加以协调。后续章节会更详细地讨论各项过程，并提出适合每种状况、回应场地条件的措施。

场地同时受到坡面侵蚀及海岸（沙滩）侵蚀的影响，两者虽有联系，但在成因、表现及管理应对上有根本差异。此外，场地过去也曾发生局部坡体移动，例如少量岩石或土体位移，目前并非处于活动状态。这类间歇发生的过程有别于渐进侵蚀，需要采取预防及风险管理方式，而非持续性的结构工程干预。

坡面侵蚀及坡体移动

海岸侵蚀

图解：丹绒武雅——虽然坡面侵蚀与沙滩侵蚀发生于同一场地，但作用于不同景观区域，必须以独立、针对性的策略管理。

Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
Slope erosion	• Surface runoff from rainfall • Loss or disturbance of vegetation • Concentrated drainage paths • Foot traffic and informal access	• Gradual loss of surface soil • Rills and shallow gullies • Exposure of underlying rock or soil	• Retention and reinforcement of vegetation • Surface stabilization (mulch, erosion mats) • Dispersed drainage and permeable surfaces • Defined paths to prevent trampling
Coastal (beach) erosion	• Wave action and tides • Seasonal monsoon conditions • Sea level rise • Altered sediment supply (reclamation, structures)	• Seasonal beach width changes • Sand loss during storms • Shoreline retreat	• Setbacks and managed retreat • Dune and upper-beach vegetation • Elevated or relocatable access • Preservation of nearshore features • Monitoring and adaptive management
Mass movement	• Historic disturbance or reclamation • Weathering of rock and soil • Intense rainfall events • Loss of root reinforcement	• Sudden, localized movement • Discrete rock or soil displacement • Episodic rather than continuous	• Vegetation retention and surface stabilization • Drainage control to prevent saturation • Targeted rockfall netting or mesh (localized) • Setbacks, access management, monitoring

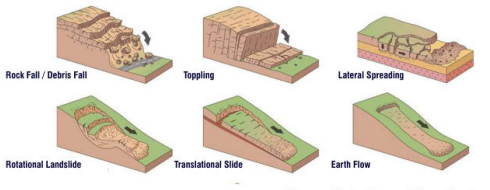


Diagram:. Typical types of **Slope Erosion**

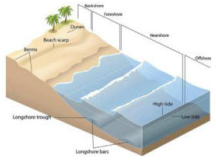


Diagram:. **Coastal Erosion** *and Deposition*

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过程 | 主要成因 | 典型特征 | 最适合的处理措施

坡面侵蚀

主要成因：降雨形成的地表径流；植被流失或受扰动；排水路径集中；行人踩踏及非正式通道。

典型特征：表层土壤逐渐流失；细沟及浅冲沟；下层岩石或土壤露出。

最适合的处理措施：保留及强化植被；地表稳固（覆盖物、防蚀垫）；分散排水及透水表面；划定步道以避免踩踏。

海岸（沙滩）侵蚀

主要成因：波浪及潮汐作用；季节性季候风条件；海平面上升；泥沙供应改变（填海、构筑物）。

典型特征：沙滩宽度随季节变化；风暴期间沙粒流失；海岸线后退。

最适合的处理措施：退缩距离与有序退让；沙丘及上部沙滩植被；架高或可迁移通道；保留近岸地貌；监测与适应性管理。

坡体移动

主要成因：历史扰动或填海；岩石及土壤风化；强降雨事件；根系加固作用流失。

典型特征：突然、局部的移动；个别岩石或土体位移；间歇发生而非持续发生。

最适合的处理措施：保留植被及稳固地表；控制排水以防土体饱和；针对性的局部落石防护网；退缩、通行管理与监测。

图解：坡面侵蚀的典型类型

图解：海岸侵蚀与沉积

落石 / 碎屑坠落

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Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
Slope erosion	• Surface runoff from rainfall • Loss or disturbance of vegetation • Concentrated drainage paths • Foot traffic and informal access	• Gradual loss of surface soil • Rills and shallow gullies • Exposure of underlying rock or soil	• Retention and reinforcement of vegetation • Surface stabilization (mulch, erosion mats) • Dispersed drainage and permeable surfaces • Defined paths to prevent trampling
Coastal (beach) erosion	• Wave action and tides • Seasonal monsoon conditions • Sea level rise • Altered sediment supply (reclamation, structures)	• Seasonal beach width changes • Sand loss during storms • Shoreline retreat	• Setbacks and managed retreat • Dune and upper-beach vegetation • Elevated or relocatable access • Preservation of nearshore features • Monitoring and adaptive management
Mass movement	• Historic disturbance or reclamation • Weathering of rock and soil • Intense rainfall events • Loss of root reinforcement	• Sudden, localized movement • Discrete rock or soil displacement • Episodic rather than continuous	• Vegetation retention and surface stabilization • Drainage control to prevent saturation • Targeted rockfall netting or mesh (localized) • Setbacks, access management, monitoring

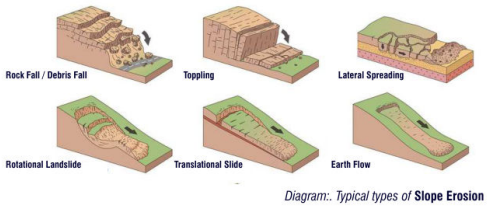


Diagram:. Typical types of **Slope Erosion**

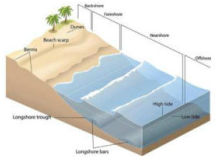


Diagram:. **Coastal Erosion** *and Deposition*

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倾倒

侧向扩展

旋转型滑坡

平移型滑动

土流

海岸侵蚀与沉积图中的分区及地貌标注：

后滨

前滨

近岸

外海

沙丘

沙滩陡坎

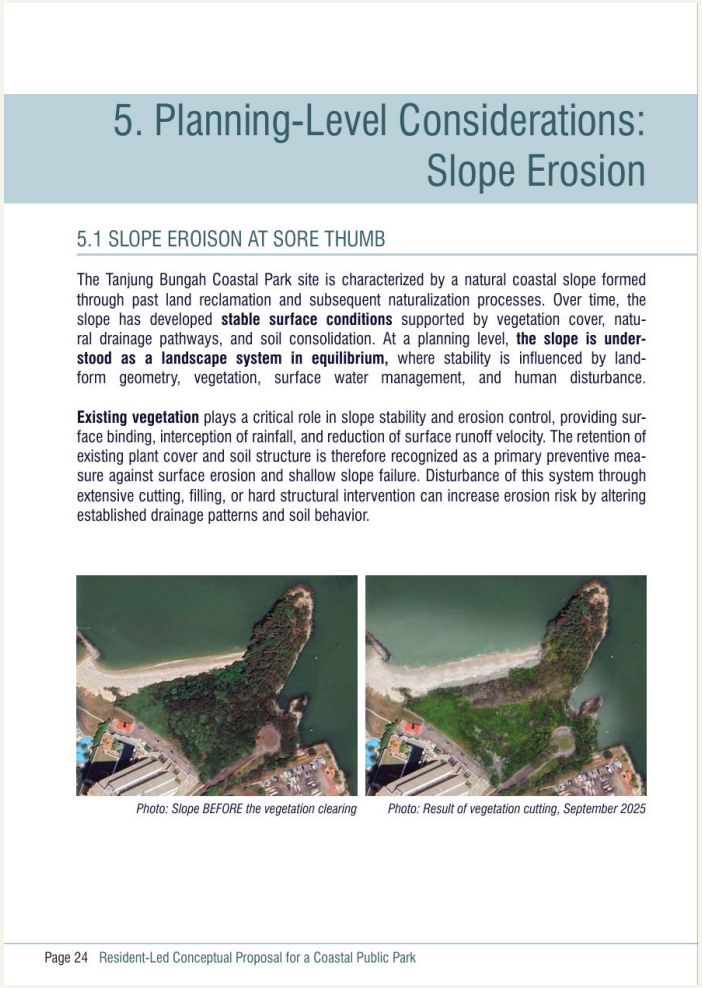
滩肩

沿岸槽

沿岸沙坝

高潮位

低潮位



5. Planning-Level Considerations: Slope Erosion

5.1 SLOPE EROISON AT SORE THUMB

The Tanjung Bungah Coastal Park site is characterized by a natural coastal slope formed through past land reclamation and subsequent naturalization processes. Over time, the slope has developed **stable surface conditions** supported by vegetation cover, natural drainage pathways, and soil consolidation. At a planning level, **the slope is understood as a landscape system in equilibrium,** where stability is influenced by landform geometry, vegetation, surface water management, and human disturbance.

Existing vegetation plays a critical role in slope stability and erosion control, providing surface binding, interception of rainfall, and reduction of surface runoff velocity. The retention of existing plant cover and soil structure is therefore recognized as a primary preventive measure against surface erosion and shallow slope failure. Disturbance of this system through extensive cutting, filling, or hard structural intervention can increase erosion risk by altering established drainage patterns and soil behavior.

Photo: Slope BEFORE the vegetation clearing

Photo: Result of vegetation cutting, September 2025

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居民主导的公共海岸公园概念建议书

5. 规划层面的考虑：坡面侵蚀

照片：植被清除前的坡面

照片：植被砍除后的情况，2025年9月

5.1 SORE THUMB的坡面侵蚀

丹绒武雅海岸公园用地具有天然化的沿海斜坡，其形成源自过去的填海及后续自然化过程。随着时间推移，在植被覆盖、天然排水路径及土壤固结的支持下，坡面形成了稳定的地表条件。在规划层面，该斜坡被理解为一个处于平衡状态的景观系统，其稳定性受地形几何、植被、地表水管理及人为扰动影响。

现有植被对边坡稳定及侵蚀控制至关重要，可固结表层、截留雨水，并降低地表径流速度。因此，保留现有植物覆盖与土壤结构，被视为预防地表侵蚀及浅层边坡失稳的首要措施。大范围挖削、填土或硬质结构干预，会改变既有排水模式及土壤行为，从而可能增加侵蚀风险。

Recent site clearing has resulted in the loss of approximately one third of the vegetated area, including the removal of **several large mature trees** with trunk circumferences **exceeding 1 meter**. This represents a substantial reduction in vegetation cover and has temporarily reduced slope stability, leading to increased surface erosion.



Photo: Tree stump ca=1,6m, October 2025



Photo: Tree stem ca=1,9m, October 2025

However, as the root systems of the removed trees were left in situ, they continue to play a **critical role in subsoil reinforcement and ground stabilization** and should therefore not be disturbed or removed. Since the clearance took place, natural regeneration has already begun, and **newly established vegetation has significantly reduced visible erosion on the slope.**

By formally integrating the slope into a park design and introducing targeted **planting selected for root structure, soil binding capacity and erosion control performance,** there is a strong basis to maintain and further improve long-term slope stability. A landscape-led approach that priorities vegetation-based stabilization provides an effective and low-impact alternative to heavy structural interventions.

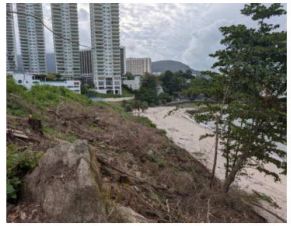


Photo: Result of vegetation cutting, September 2025

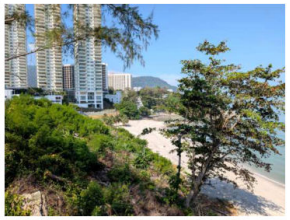


Photo: Vegetation regeneration, January 2026

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近期场地清理造成约三分之一植被面积流失，包括砍除数棵树干周长超过1米的大型成熟树木。这意味着植被覆盖大幅减少，并暂时降低边坡稳定性，导致地表侵蚀加剧。

照片：树桩，周长约1.6米，2025年10月

照片：树干，周长约1.9米，2025年10月

不过，被砍树木的根系仍留在原地，继续发挥加固地下土层及稳定地面的关键作用，因此不应扰动或移除。自清理之后，自然再生已开始，新长出的植被已明显减轻坡面可见的侵蚀。

将斜坡正式纳入公园设计，并根据根系结构、固土能力及防蚀表现进行针对性种植，可为维持及进一步改善长期边坡稳定提供有力基础。以景观为主导、优先运用植被稳定边坡的方法，是重型结构干预之外有效且低影响的替代方案。

照片：植被砍除后的情况，2025年9月

照片：植被再生，2026年1月



5.2 SLOPE EROSION CONTROL: PRINCIPLES AND MEASURES

Slope erosion is a natural process that can be significantly accelerated by vegetation removal, surface disturbance and unmanaged runoff. Effective erosion control relies on selecting measures that are proportionate to the severity of site conditions, rather than defaulting to heavy engineering solutions.

Any proposal that depends on extensive structural slope stabilization or major alteration of the existing landform should be supported by ***site-specific geotechnical evidence*** *demonstrating that landscape-led measures are insufficient.*

Best practice in slope management follows a graduated response, where the level of intervention matches the degree of risk:

- **Low-risk slopes** with shallow erosion and existing vegetation require minimal intervention focused on surface stabilization and vegetation recovery(Sore Thumb),
- **Moderate-risk** slopes with partial vegetation loss and surface runoff benefit from combined bioengineering and light structural measures.
- **High-risk slopes** with deep-seated instability, active slips or geotechnical failure may require engineered solutions, supported by detailed geotechnical assessment.

In the absence of evidence of deep slope failure, landscape-led and bioengineering approaches are generally preferred.

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任何依赖大范围结构性边坡加固，或大幅改变现有地形的建议，都应有针对该场地的岩土工程证据支持，证明以景观为主导的措施不足以解决问题。

5.2 坡面侵蚀控制：原则与措施

坡面侵蚀是自然过程，但植被移除、地表扰动及径流失控，均可显著加速侵蚀。有效的侵蚀控制应根据场地状况的严重程度选择相称措施，而不是默认采用重型工程方案。

• 侵蚀较浅且已有植被的低风险边坡，需要最小限度干预，重点是稳固地表及恢复植被（Sore Thumb）。

• 部分植被流失、存在地表径流的中等风险边坡，可通过结合生物工程及轻型结构措施获益。

• 存在深层不稳定、活动性滑动或岩土失效的高风险边坡，可能需要工程解决方案，并须由详细岩土评估支持。

在没有深层边坡破坏证据的情况下，通常应优先选择以景观为主导及生物工程的方法。

边坡管理的良好做法采取分级应对，让干预程度与风险程度相匹配。



Photo: Example of a Hight Risk Erosion

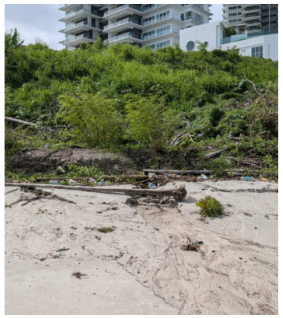


Photo: Example Low-risk erosion resulting from recent vegetation clearing at the site.

Hierarchy of Measures

Slope erosion can be effectively managed through graduated, site-responsive measures, where the level of intervention matches the severity of on-site conditions. In the absence of evidence of deep-seated slope failure, landscape-led and vegetation-based solutions should be prioritized.

Low to Moderate Risk (preferred approach)

- Retention of existing root systems
- Re-vegetation using native, deep-rooting and soil-binding species
- Groundcovers and shrubs to protect exposed soil
- Biodegradable erosion control mats (coir, jute)
- Surface runoff slowed using shallow swales and contour planting

Moderate Risk (localized support only)

- Light, permeable structures supporting paths or steps
- Small retaining elements integrated into landscape
- Drainage measures to intercept and disperse surface water

High Risk (only if proven by evidence)

- Engineered slope stabilization
- Structural retaining systems
- Requires site-specific geotechnical assessment

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照片：高风险侵蚀的例子

照片：场地近期植被清除导致低风险侵蚀的例子

坡面侵蚀可通过分级、回应场地条件的措施有效管理，使干预程度与现场情况的严重性相匹配。在没有深层边坡破坏证据的情况下，应优先选择以景观及植被为本的解决方案。

低至中等风险（优先方法）

• 保留现有根系。

• 使用本土、深根及固土能力强的植物恢复植被。

• 以地被及灌木保护裸露土壤。

• 使用可生物降解的防蚀垫（椰纤维、黄麻）。

• 通过浅洼沟及沿等高线种植减缓地表径流。

中等风险（仅作局部支撑）

• 使用轻型、透水结构支撑步道或阶梯。

• 将小型挡土构件融入景观。

• 设置排水措施，以截流及分散地表水。

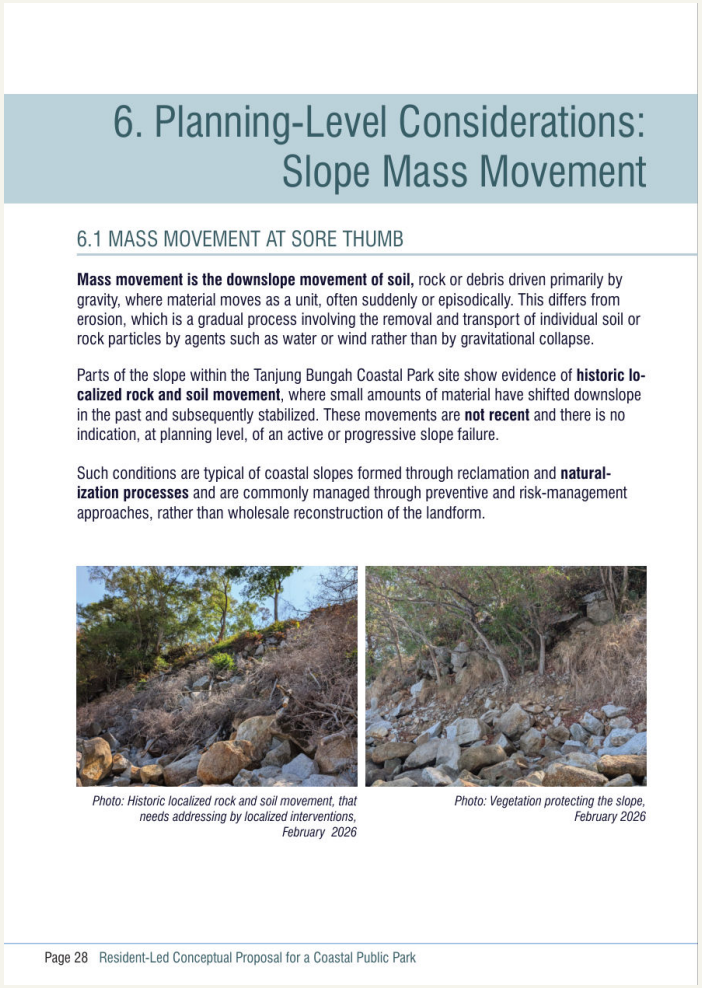
高风险（仅在证据确认时）

• 进行工程化边坡加固。

• 使用结构性挡土系统。

• 须进行针对该场地的岩土评估。

措施的层级次序



6. Planning-Level Considerations: Slope Mass Movement

6.1 MASS MOVEMENT AT SORE THUMB

Mass movement is the downslope movement of soil, rock or debris driven primarily by gravity, where material moves as a unit, often suddenly or episodically. This differs from erosion, which is a gradual process involving the removal and transport of individual soil or rock particles by agents such as water or wind rather than by gravitational collapse.

Parts of the slope within the Tanjung Bungah Coastal Park site show evidence of **historic localized rock and soil movement**, where small amounts of material have shifted downslope in the past and subsequently stabilized. These movements are **not recent** and there is no indication, at planning level, of an active or progressive slope failure.

Such conditions are typical of coastal slopes formed through reclamation and **naturalization processes** and are commonly managed through preventive and risk-management approaches, rather than wholesale reconstruction of the landform.

Photo: Historic localized rock and soil movement, that needs addressing by localized interventions, February 2026

Photo: Vegetation protecting the slope, February 2026

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6. 规划层面的考虑：坡体移动

6.1 SORE THUMB的坡体移动

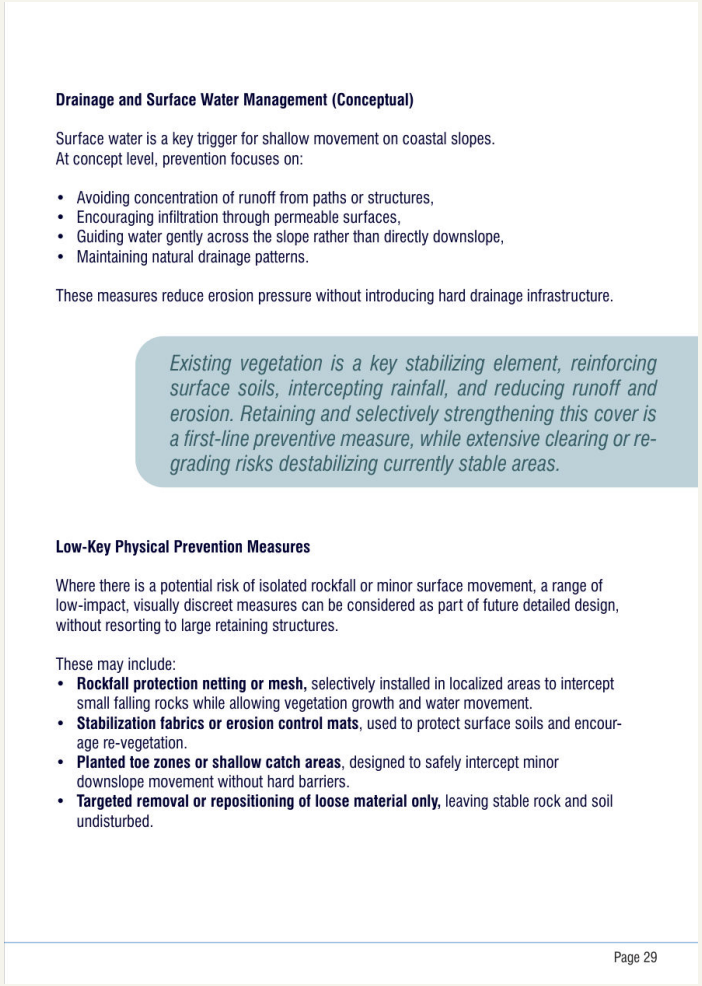
坡体移动是土壤、岩石或碎屑主要在重力作用下沿坡向下移动的现象，物料作为整体移动，往往突然或间歇发生。它不同于侵蚀：侵蚀是水或风等作用逐步移除和搬运个别土粒或岩屑的过程，而非由重力坍塌造成。

照片：保护坡面的植被，2026年2月

照片：历史上局部岩石和土体移动的痕迹，需要以局部干预处理，2026年2月

丹绒武雅海岸公园场地的部分斜坡显示，过去曾有局部岩石和土体移动，少量物料沿坡下移后已趋于稳定。这些移动并非近期发生，在规划层面的判断中，没有活动性或持续发展中的边坡破坏迹象。

这些情况常见于通过填海及自然化过程形成的沿海边坡，通常通过预防及风险管理方式处理，而非全面重建地形。



Drainage and Surface Water Management (Conceptual)

Surface water is a key trigger for shallow movement on coastal slopes.
At concept level, prevention focuses on:

- Avoiding concentration of runoff from paths or structures,
- Encouraging infiltration through permeable surfaces,
- Guiding water gently across the slope rather than directly downslope,
- Maintaining natural drainage patterns.

These measures reduce erosion pressure without introducing hard drainage infrastructure.

Existing vegetation is a key stabilizing element, reinforcing surface soils, intercepting rainfall, and reducing runoff and erosion. Retaining and selectively strengthening this cover is a first-line preventive measure, while extensive clearing or re-grading risks destabilizing currently stable areas.

Low-Key Physical Prevention Measures

Where there is a potential risk of isolated rockfall or minor surface movement, a range of low-impact, visually discreet measures can be considered as part of future detailed design, without resorting to large retaining structures.

These may include:

- **Rockfall protection netting or mesh,** selectively installed in localized areas to intercept small falling rocks while allowing vegetation growth and water movement.
- **Stabilization fabrics or erosion control mats**, used to protect surface soils and encourage re-vegetation.
- **Planted toe zones or shallow catch areas**, designed to safely intercept minor downslope movement without hard barriers.
- **Targeted removal or repositioning of loose material only,** leaving stable rock and soil undisturbed.

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现有植被是关键的稳定因素，可加固表层土壤、截留降雨，并减少径流及侵蚀。保留并有选择地强化植被覆盖，是首要预防措施；大范围清除植被或重新整坡，则可能使目前稳定的区域失稳。

排水及地表水管理（概念层面）

地表水是触发沿海边坡浅层移动的重要因素。

在概念层面，预防重点包括：

- 避免步道或构筑物的径流集中；
- 通过透水表面促进渗透；
- 温和地引导水流横向通过坡面，而非直接顺坡下流；
- 维持天然排水模式。

这些措施无须引入硬质排水设施，也能减轻侵蚀压力。

低干预实体预防措施

若存在个别落石或轻微地表移动的潜在风险，可在日后详细设计中考虑多种低影响、视觉上不显眼的措施，无须诉诸大型挡土结构。

可能的措施包括：

- 落石防护网：有选择地安装于局部区域，拦截小型落石，同时容许植被生长及水流通过。
- 稳固土工织物或防蚀垫：用于保护表层土壤，并促进植被恢复。
- 植被覆盖的坡脚区域或浅层拦截区：在不设置硬质屏障的情况下，安全拦截轻微的坡下移动。
- 仅针对松动物料进行清除或重新安置，避免扰动稳定的岩石和土壤。

Mass movement at the site has occurred **as localized, episodic events** rather than as continuous slope failure, and should therefore be addressed through targeted, localized treatment. Preventive measures may include lightweight interventions such as rockfall netting or mesh installed only in less stable areas, designed to intercept minor movement without altering the overall landform. These measures can be combined with vegetation-based stabilization, allowing plant growth to continue through and around the structures, thereby maintaining slope performance, ecological function, and visual continuity while managing residual risk.



Photo: Metal mesh – a simple, low-cost protective measure used to contain loose rock and prevent small-scale rockfalls, while preserving the natural slope profile and allowing vegetation to establish.



Photo: Geogrid – an efficient, low-cost, low-tech method for stabilizing slopes by reinforcing soil while allowing vegetation and natural drainage to remain intact.

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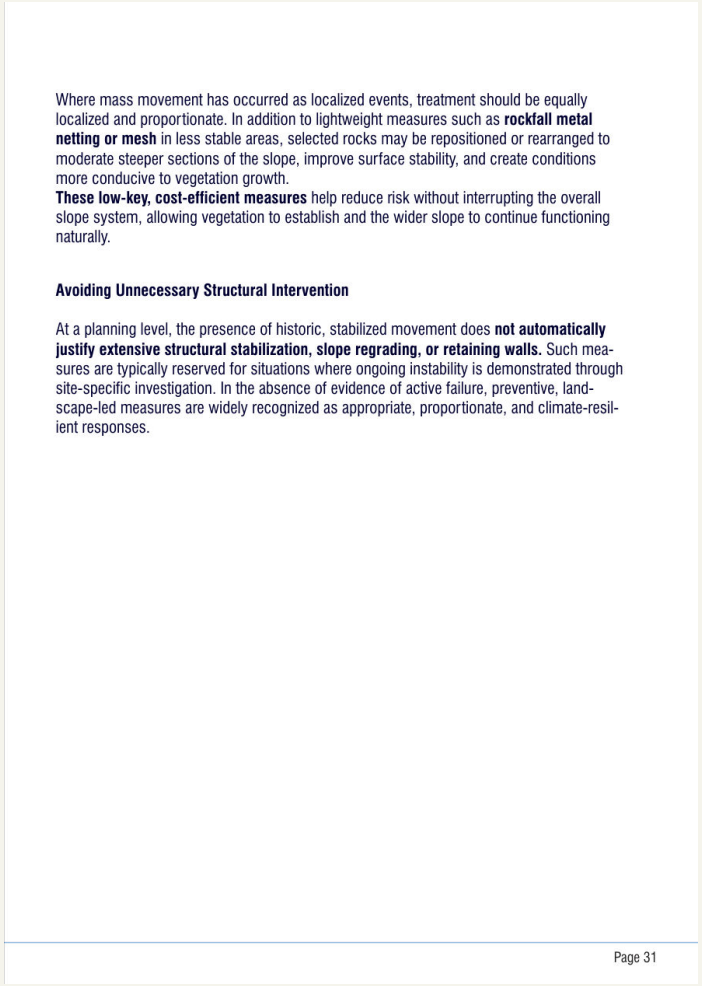
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居民主导的公共海岸公园概念建议书

场地的坡体移动表现为局部、间歇性事件，而非持续性边坡破坏，因此应采用针对性的局部处理。预防措施可包括轻量干预，例如只在较不稳定区域安装落石防护网，以拦截轻微移动，而不改变整体地形。这些措施可与植被稳定方法结合，让植物继续穿过构件及在其周边生长，从而在管理剩余风险的同时，维持边坡表现、生态功能及视觉连续性。

照片：金属网——一种简单、低成本的防护措施，可约束松动岩石并防止小规模落石，同时保留天然坡面轮廓并容许植被生长。

照片：土工格栅——一种有效、低成本、低技术门槛的稳坡方法，通过加固土壤，让植被及天然排水保持完整。



Where mass movement has occurred as localized events, treatment should be equally localized and proportionate. In addition to lightweight measures such as **rockfall metal netting or mesh** in less stable areas, selected rocks may be repositioned or rearranged to moderate steeper sections of the slope, improve surface stability, and create conditions more conducive to vegetation growth.
These low-key, cost-efficient measures help reduce risk without interrupting the overall slope system, allowing vegetation to establish and the wider slope to continue functioning naturally.

Avoiding Unnecessary Structural Intervention

At a planning level, the presence of historic, stabilized movement does **not automatically justify extensive structural stabilization, slope regrading, or retaining walls.** Such measures are typically reserved for situations where ongoing instability is demonstrated through site-specific investigation. In the absence of evidence of active failure, preventive, landscape-led measures are widely recognized as appropriate, proportionate, and climate-resilient responses.

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若坡体移动属于局部事件，处理也应同样局部化，并与风险相称。除了在较不稳定区域采用落石金属网等轻量措施外，也可有选择地重新安置或排列部分岩石，以缓和较陡坡段、改善表层稳定，并创造更有利于植物生长的条件。

这些低干预、具成本效益的措施，有助于降低风险而不打断整体边坡系统，让植被建立，并使更大范围的斜坡继续自然运作。

避免不必要的结构干预

在规划层面，存在过去已稳定的移动痕迹，并不自动构成大范围结构加固、重新整坡或修建挡土墙的理由。此类措施通常只适用于经场地专项调查确认仍持续不稳定的情况。在没有活动性破坏证据时，预防性、以景观为主导的措施，普遍被认为是适当、相称且具气候韧性的应对方法。

7. Planning-Level Considerations: Coastal / Beach Erosion

7.1 RECENT COASTAL EROSION IN PENANG (JANUARY 2026)

Severe erosion has been observed along Batu Ferringhi and Tanjung Bungah beaches, where stretches of shoreline have been progressively worn away, sand has been lost, and trees have toppled into the sea due to wave action and tidal forces. This continued erosion has been serious enough to prompt government attention and planned mitigation works.



Photo: Erosion in Penang, January 2026

However **no comparable level of erosion has been recorded along the Tanjung Bungah Beach adjacent to the Sore Thumb**. The shoreline in this area has remained relatively stable, with beach width and landform largely intact when compared to more exposed sections nearby.
This indicates that the **beach is currently sufficiently protected** by its existing coastal configuration, including the natural landform of the Sore Thumb itself, which acts as a physical buffer against wave energy. The presence of this natural shore structure has helped dissipate wave forces and reduce direct erosion pressure, reinforcing the importance of retaining the site's existing form rather than introducing interventions that could disrupt this established balance.

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居民主导的公共海岸公园概念建议书

7. 规划层面的考虑：海岸 / 沙滩侵蚀

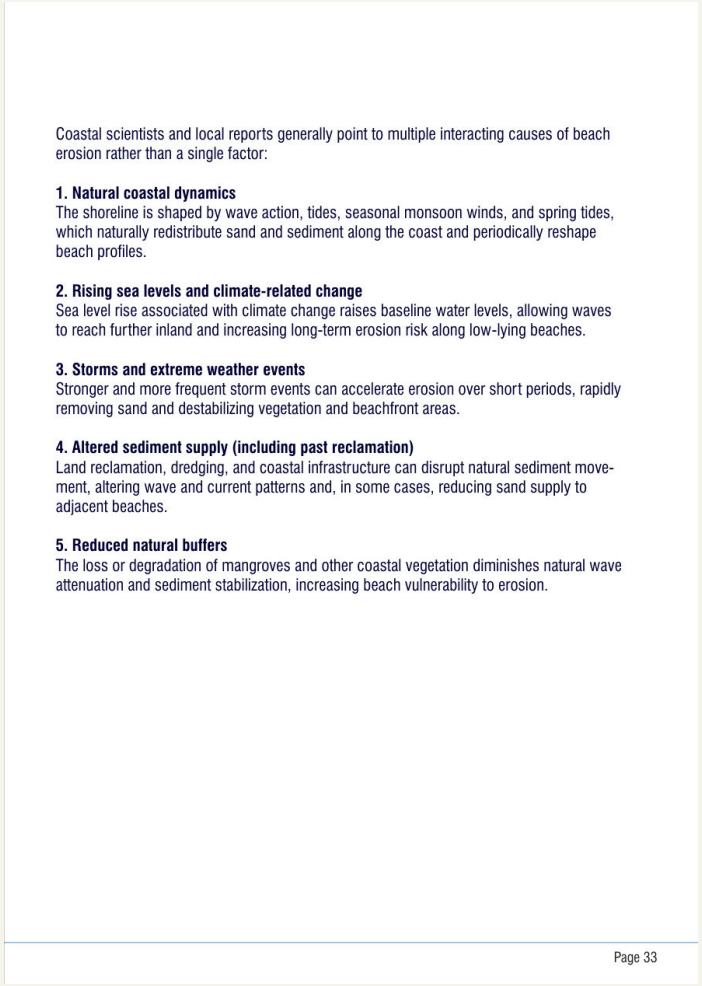
7.1 槟城近期的海岸侵蚀（2026年1月）

峇都丁宜及丹绒武雅沿岸已观察到严重侵蚀，部分海岸线逐渐被冲刷、沙粒流失，树木因波浪及潮汐力量倒入海中。持续侵蚀的严重程度已引起政府关注，并计划实施缓解工程。

照片：槟城侵蚀情况，2026年1月

不过，毗邻Sore Thumb的丹绒武雅沙滩并未录得相当程度的侵蚀。相较附近更暴露的海岸段，这里的海岸线仍相对稳定，沙滩宽度及地形基本保持完整。

这表明沙滩目前得到现有海岸形态的充分保护，包括Sore Thumb本身的天然化地形，作为抵御波浪能量的实体缓冲。现有岸线结构有助于耗散波浪力量、减轻直接侵蚀压力，进一步强化了保留场地现有形态的重要性，而非引入可能破坏既有平衡的干预。



Coastal scientists and local reports generally point to multiple interacting causes of beach erosion rather than a single factor:

1. Natural coastal dynamics
The shoreline is shaped by wave action, tides, seasonal monsoon winds, and spring tides, which naturally redistribute sand and sediment along the coast and periodically reshape beach profiles.

2. Rising sea levels and climate-related change
Sea level rise associated with climate change raises baseline water levels, allowing waves to reach further inland and increasing long-term erosion risk along low-lying beaches.

3. Storms and extreme weather events
Stronger and more frequent storm events can accelerate erosion over short periods, rapidly removing sand and destabilizing vegetation and beachfront areas.

4. Altered sediment supply (including past reclamation)
Land reclamation, dredging, and coastal infrastructure can disrupt natural sediment movement, altering wave and current patterns and, in some cases, reducing sand supply to adjacent beaches.

5. Reduced natural buffers
The loss or degradation of mangroves and other coastal vegetation diminishes natural wave attenuation and sediment stabilization, increasing beach vulnerability to erosion.

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海岸科学家及当地报道一般认为，沙滩侵蚀由多种相互作用的因素造成，而非单一原因：

1. 天然海岸动态

海岸线受到波浪、潮汐、季节性季候风及大潮塑造。这些作用会自然地沿岸重新分配沙粒与泥沙，并周期性改变沙滩剖面。

2. 海平面上升及气候相关变化

与气候变化有关的海平面上升会抬高基础水位，使波浪能够深入内陆，并增加低洼沙滩长期受侵蚀的风险。

3. 风暴及极端天气事件

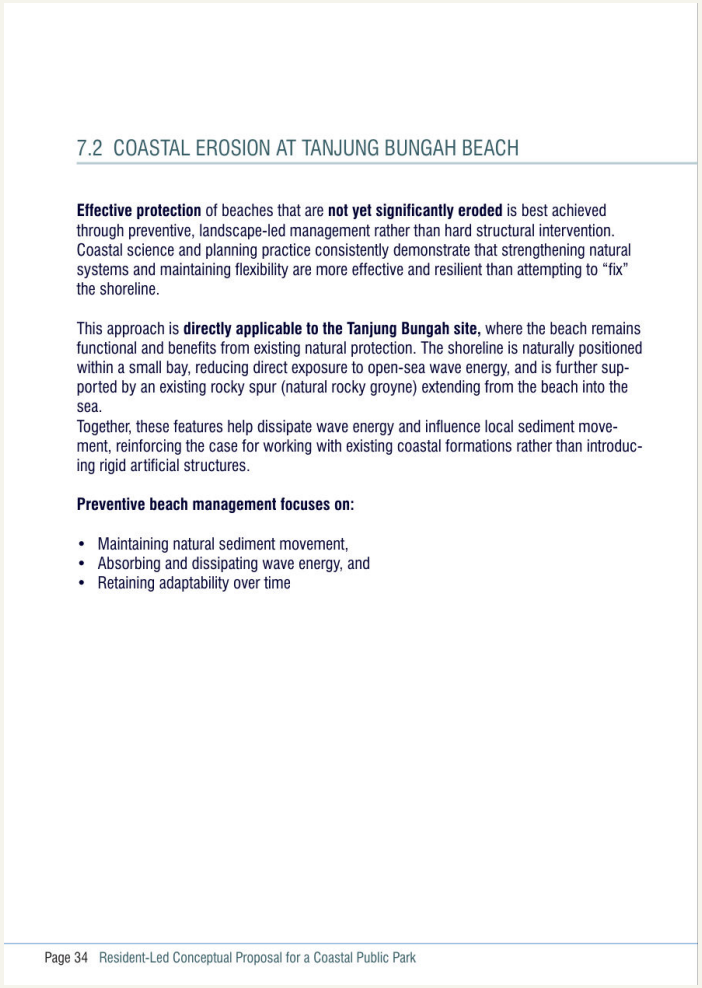
更强、更频繁的风暴可在短期内加速侵蚀，迅速带走沙粒，并使植被及海滨地区变得不稳定。

4. 泥沙供应改变（包括过去的填海活动）

填海、疏浚及海岸基础设施可扰乱天然泥沙移动，改变波浪及水流模式，并在某些情况下减少邻近沙滩的沙源供应。

5. 天然缓冲减少

红树林及其他海岸植被的流失或退化，会削弱天然消浪及稳沙作用，使沙滩更易受侵蚀。



7.2 COASTAL EROSION AT TANJUNG BUNGAH BEACH

Effective protection of beaches that are **not yet significantly eroded** is best achieved through preventive, landscape-led management rather than hard structural intervention. Coastal science and planning practice consistently demonstrate that strengthening natural systems and maintaining flexibility are more effective and resilient than attempting to "fix" the shoreline.

This approach is **directly applicable to the Tanjung Bungah site,** where the beach remains functional and benefits from existing natural protection. The shoreline is naturally positioned within a small bay, reducing direct exposure to open-sea wave energy, and is further supported by an existing rocky spur (natural rocky groyne) extending from the beach into the sea.
Together, these features help dissipate wave energy and influence local sediment movement, reinforcing the case for working with existing coastal formations rather than introducing rigid artificial structures.

Preventive beach management focuses on:

- Maintaining natural sediment movement,
- Absorbing and dissipating wave energy, and
- Retaining adaptability over time

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居民主导的公共海岸公园概念建议书

对于尚未受到严重侵蚀的沙滩，最有效的保护方式是预防性、以景观为主导的管理，而非硬质结构干预。海岸科学及规划实践一贯显示，强化自然系统、保留适应空间，比试图"固定"海岸线更有效、更有韧性。

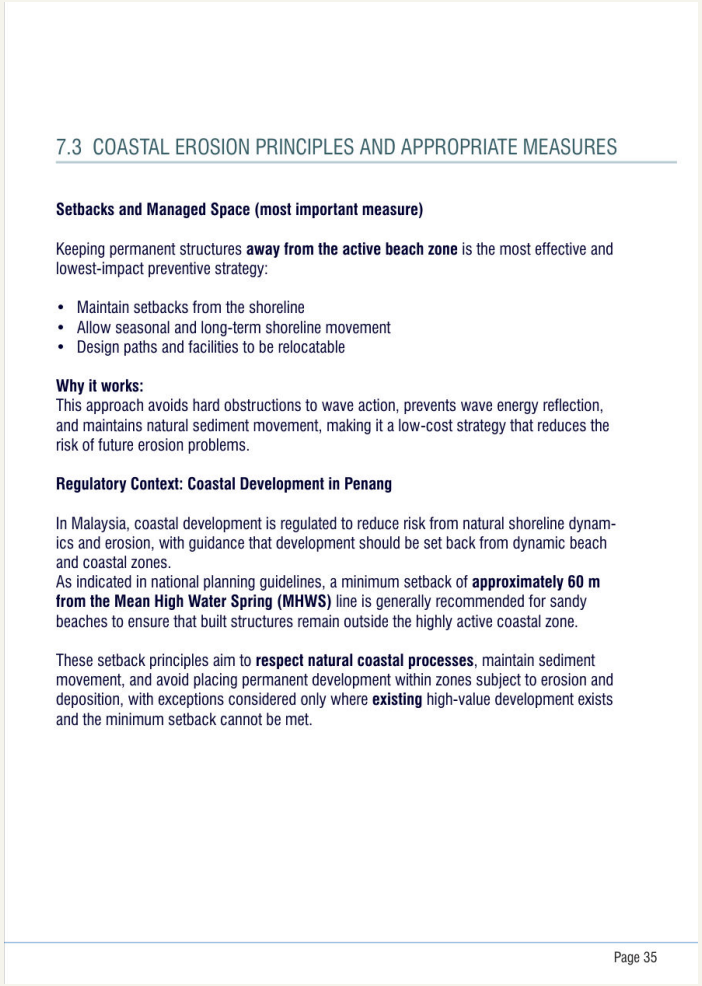
这一方法直接适用于丹绒武雅场地，因为沙滩仍具正常功能，并受益于现有天然保护。海岸线天然位于一个小海湾内，减少了对外海波浪能量的直接暴露；此外，还有一条从沙滩延伸入海的现有岩石岬脊（天然岩质丁坝）提供支持。

这些特征共同有助于耗散波浪能量，并影响地方泥沙移动，强化了顺应现有海岸形态、而非引入刚性人工结构的理由。

预防性沙滩管理重点是：

- 维持天然泥沙移动；
- 吸收及耗散波浪能量；以及
- 长期保留适应能力。

7.2 丹绒武雅沙滩的海岸侵蚀



7.3 COASTAL EROSION PRINCIPLES AND APPROPRIATE MEASURES

Setbacks and Managed Space (most important measure)

Keeping permanent structures **away from the active beach zone** is the most effective and lowest-impact preventive strategy:

- Maintain setbacks from the shoreline
- Allow seasonal and long-term shoreline movement
- Design paths and facilities to be relocatable

Why it works:
This approach avoids hard obstructions to wave action, prevents wave energy reflection, and maintains natural sediment movement, making it a low-cost strategy that reduces the risk of future erosion problems.

Regulatory Context: Coastal Development in Penang

In Malaysia, coastal development is regulated to reduce risk from natural shoreline dynamics and erosion, with guidance that development should be set back from dynamic beach and coastal zones.
As indicated in national planning guidelines, a minimum setback of **approximately 60 m from the Mean High Water Spring (MHWS)** line is generally recommended for sandy beaches to ensure that built structures remain outside the highly active coastal zone.

These setback principles aim to **respect natural coastal processes**, maintain sediment movement, and avoid placing permanent development within zones subject to erosion and deposition, with exceptions considered only where **existing** high-value development exists and the minimum setback cannot be met.

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退缩及空间管理（最重要的措施）

让永久建筑远离活跃沙滩区，是最有效、影响最低的预防策略：

• 与海岸线保持退缩距离；

• 容许海岸线随季节及长期过程移动；

• 将步道及设施设计为可迁移。

为何有效：

此方法避免硬质障碍干扰波浪作用，防止波浪能量反射，并维持天然泥沙移动，是一种低成本且能减少未来侵蚀问题风险的策略。

监管背景：槟城海岸发展

马来西亚对海岸发展进行监管，以降低天然海岸线动态及侵蚀带来的风险；相关指引要求发展项目应从动态的沙滩及海岸区域后退。

国家规划指引指出，对于沙质海滩，一般建议自平均大潮高潮线（Mean High Water Spring，MHWS）起，保留约60米的最低退缩距离，确保建筑结构位于高度活跃海岸区之外。

这些退缩原则旨在尊重天然海岸过程、维持泥沙移动，并避免在受侵蚀及沉积影响的区域设置永久发展项目。只有在已有高价值发展、且无法满足最低退缩距离的情况下，才考虑例外。

7.3 海岸侵蚀的原则与适当措施



Dune and Upper-Beach Vegetation

Dune and upper-beach vegetation function as coastal infrastructure rather than decoration. Creeping vines such as *Ipomoea pes-caprae*, coastal grasses including *Spinifex* and low shrubs such as *Scaevola* and *Vitex* play a critical role in trapping and retaining sand, stabilizing surface sediments, reducing wind erosion, and absorbing wave run-up energy. Healthy, continuous vegetation cover in these zones is therefore a key indicator of beach resilience and an essential component of preventive coastal management.

Photo: Coastal Vegetation: Spinifex littoreus

Photo: Coastal Vegetation: Scaevola taccada

Photo: Coastal Vegetation: Vitex trifolia

Photo: Coastal Vegetation: Ipomoea pes-caprae

The proposed concept **reinforces and enhances this natural protection** by introducing and supporting vegetation that is well suited to coastal conditions and effective for beach stabilization.
The planting approach priorities **native and coastal-adapted species** that tolerate salt spray, wind, and sandy soils, and that contribute directly to sediment retention, surface stabilization, and erosion prevention. Importantly, the entire Sore Thumb hill functions as a large-scale natural buffer, reducing wind exposure, intercepting runoff, and dissipating wave and storm energy before it reaches the beach. In the context of climate change and rising sea levels, retaining and strengthening this vegetated landform provides a **resilient, landscape-led defense against land and sand loss**, demonstrating that the site already performs a significant protective role without the need for hard coastal structures.

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居民主导的公共海岸公园概念建议书

沙丘及上部沙滩植被

沙丘及上部沙滩植被发挥的是海岸基础设施作用，而非仅供装饰。马鞍藤（Ipomoea pes-caprae）等匍匐藤本、鬣刺属（Spinifex）等海岸草类，以及草海桐属（Scaevola）、牡荆属（Vitex）等低矮灌木，在捕获和保留沙粒、稳定表层泥沙、减少风蚀及吸收波浪爬升能量方面发挥关键作用。因此，这些地带健康、连续的植被覆盖，是沙滩韧性的重要指标，也是预防性海岸管理不可缺少的组成部分。

照片：海岸植被——草海桐（Scaevola taccada）

照片：海岸植被——滨刺麦（Spinifex littoreus）

照片：海岸植被——三叶蔓荆（Vitex trifolia）

照片：海岸植被——马鞍藤（Ipomoea pes-caprae）

拟议概念通过引入及支持适合海岸条件、能有效稳定沙滩的植被，强化并改善现有天然保护。

种植方式优先选用本土及适应海岸环境的物种，须能耐受盐雾、风及沙质土壤，并直接帮助保留泥沙、稳固地表及防止侵蚀。尤其重要的是，整座Sore Thumb小山发挥大尺度天然缓冲作用，在风浪及风暴能量到达沙滩之前，减少风力暴露、截留径流并耗散能量。在气候变化与海平面上升的背景下，保留并强化这片植被覆盖的地形，可形成具韧性、以景观为本的防线，抵御土地及沙粒流失，显示场地无须硬质海岸结构，也已发挥重要保护作用。

Preservation of Natural Nearshore Features and Breakwater Function

Natural nearshore features such as **shallow reefs, rocky outcrops, and natural seabed formations** play an important protective role by functioning as a natural breakwater system. These features dissipate wave energy offshore, reduce wave height before it reaches the shoreline, and help stabilize nearshore sediments, supporting the natural balance of sand movement along the coast.

At the Tanjung Bungah "Sore Thumb" site, this function is already present through an existing of-shore **rocky breakwater** extending from the beach into the sea. This formation contributes to partial sheltering of the beach and influences local sediment dynamics, reducing direct erosive pressure on the shoreline.

The removal or alteration of such nearshore features often worsens erosion by eliminating this first line of wave energy dissipation and disrupting sediment pathways. For this reason, **preservation of existing formations is a key preventive measure**.

Should future monitoring indicate the need for additional protection, the existing natural breakwater function could be carefully reinforced or elaborated, building on what already works rather than introducing rigid artificial structures. This approach maintains flexibility, limits environmental impact, and supports long-term coastal resilience.

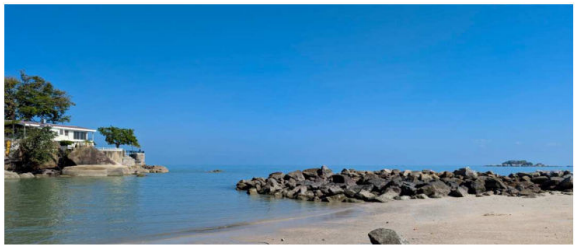


Photo: Existing breakwater efficiently protecting the beach

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照片：现有防波地形有效保护沙滩

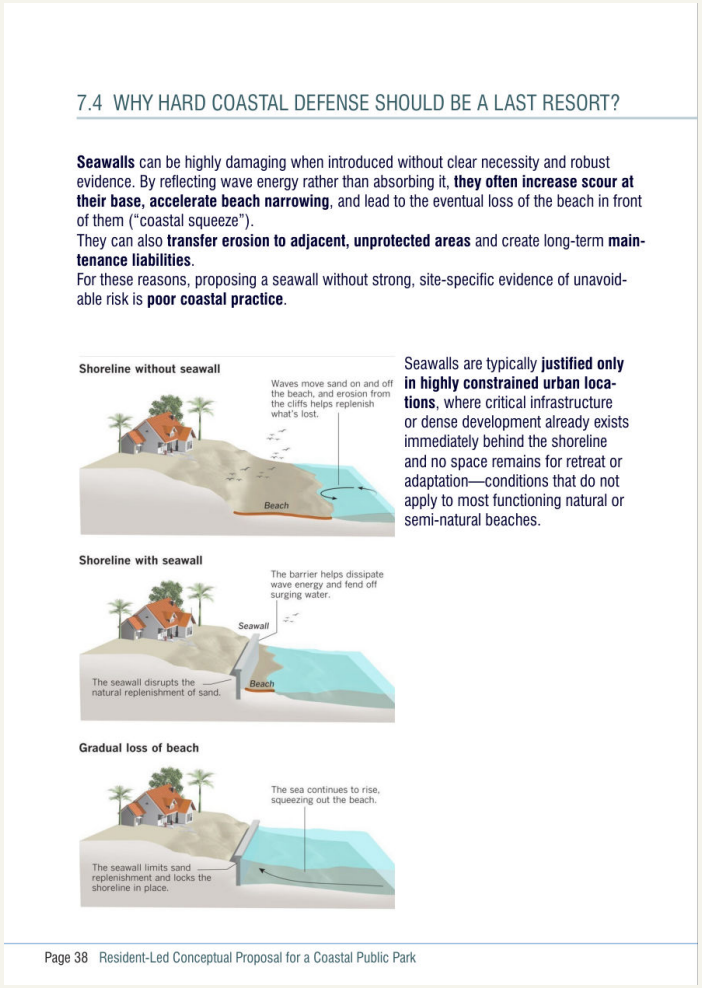
保留天然近岸地貌及防波功能

浅礁、岩石露头及天然海床形态等近岸地貌，可作为天然防波系统，发挥重要保护作用。这些地貌在离岸处耗散波浪能量，在波浪抵达海岸前降低浪高，并帮助稳定近岸泥沙，支持沿岸沙粒移动的自然平衡。

在丹绒武雅"Sore Thumb"场地，现有从沙滩延伸入海的离岸岩质防波地形，已具备这一功能。该地形为沙滩提供部分遮护，并影响地方泥沙动态，减少对海岸线的直接侵蚀压力。

移除或改造这类近岸地貌，往往因消除了首道波能耗散屏障、扰乱泥沙路径而加剧侵蚀。因此，保留现有地形是重要的预防措施。

若未来监测显示需要额外保护，可审慎强化或延伸现有天然防波功能，在已有效的基础上改进，而非引入刚性人工结构。这种方法可维持灵活性、限制环境影响，并支持长期海岸韧性。



7.4 WHY HARD COASTAL DEFENSE SHOULD BE A LAST RESORT?

Seawalls can be highly damaging when introduced without clear necessity and robust evidence. By reflecting wave energy rather than absorbing it, **they often increase scour at their base, accelerate beach narrowing**, and lead to the eventual loss of the beach in front of them ("coastal squeeze").
They can also **transfer erosion to adjacent, unprotected areas** and create long-term **maintenance liabilities**.
For these reasons, proposing a seawall without strong, site-specific evidence of unavoidable risk is **poor coastal practice**.

Shoreline without seawall

Waves move sand on and off the beach, and erosion from the cliffs helps replenish what's lost.

Beach

Seawalls are typically **justified only in highly constrained urban locations**, where critical infrastructure or dense development already exists immediately behind the shoreline and no space remains for retreat or adaptation—conditions that do not apply to most functioning natural or semi-natural beaches.

Shoreline with seawall

The barrier helps dissipate wave energy and fend off surging water.

Seawall

The seawall disrupts the natural replenishment of sand.

Beach

Gradual loss of beach

The sea continues to rise, squeezing out the beach.

The seawall limits sand replenishment and locks the shoreline in place.

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居民主导的公共海岸公园概念建议书

如果没有明确必要性及可靠证据就设置海堤，可能造成严重损害。海堤反射而非吸收波浪能量，往往增加底部冲刷、加速沙滩变窄，最终使其前方沙滩消失（“海岸挤压”）。

海堤也可能把侵蚀转移到邻近未受保护的区域，并形成长期维护负担。

因此，在缺乏强而有力、针对场地的证据证明风险无法避免时提出修建海堤，并非良好的海岸管理做法。

7.4 为何硬质海岸防护应是最后手段？

海堤通常只在空间高度受限的城市地段才具有合理性：重要基础设施或密集发展已紧贴海岸线后方，且没有空间退让或适应变化。这些条件并不适用于大多数仍具正常功能的天然或半天然沙滩。

图解：未设海堤的海岸线

波浪将沙粒带向沙滩及带离沙滩，海崖侵蚀有助于补充流失的沙粒。

沙滩

图解：设有海堤的海岸线

屏障有助于耗散波浪能量，并抵挡涌上的海水。

海堤

海堤扰乱沙粒的天然补充过程。

沙滩

图解：沙滩逐渐流失

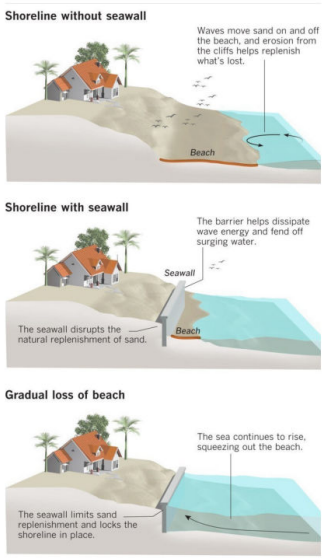
海平面持续上升，挤占沙滩空间。

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海堤限制沙粒补充，并将海岸线固定在原位。

7.4 WHY HARD COASTAL DEFENSE SHOULD BE A LAST RESORT?

Seawalls can be highly damaging when introduced without clear necessity and robust evidence. By reflecting wave energy rather than absorbing it, **they often increase scour at their base, accelerate beach narrowing**, and lead to the eventual loss of the beach in front of them ("coastal squeeze").
They can also **transfer erosion to adjacent, unprotected areas** and create long-term **maintenance liabilities**.
For these reasons, proposing a seawall without strong, site-specific evidence of unavoidable risk is **poor coastal practice**.



Seawalls are typically **justified only in highly constrained urban locations**, where critical infrastructure or dense development already exists immediately behind the shoreline and no space remains for retreat or adaptation—conditions that do not apply to most functioning natural or semi-natural beaches.

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Infrastructure built directly at the shoreline is **inherently costly to maintain** and **highly vulnerable to damage or failure** during extreme weather events. Continuous exposure to saltwater, wave impact, and tidal action accelerates material deterioration, increasing the risk of structural damage, repeated repair, and eventual demolition.



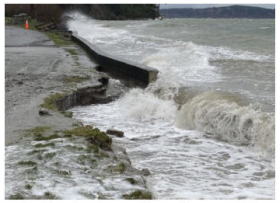


Photo: Infrastructure built close to the shoreline is never a one-time investment, as ongoing maintenance and damage repair from wave action and extreme weather result in high long-term costs.

Experience in Penang has shown that seawalls, where previously introduced, often make beach spaces **difficult or unusable**. By fixing the shoreline, they commonly lead to beach narrowing or complete loss of the beach during high tides, reducing public access and recreational value.
Seawalls are not only **expensive to maintain, prone to deterioration in harsh marine conditions,** and **vulnerable to vandalism**.

Ecologically, they create a "dead coast"—a hard edge with little or no habitat value for coastal flora and fauna. Over time, these impacts undermine both environmental quality and public benefit, while locking authorities into long-term maintenance costs.



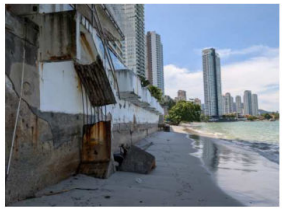


Photo: Narrowing beach reduced escape space during high tide increases public health and safety risks, potentially trapping beach users between rising water and hard structures with limited ability to avoid wave impact. Penang 2025

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槟城的经验显示，过去修建海堤的地方，沙滩空间往往变得难以使用，甚至无法使用。海堤固定海岸线，常导致沙滩变窄，或在高潮时完全消失，降低公众通达性及休闲价值。

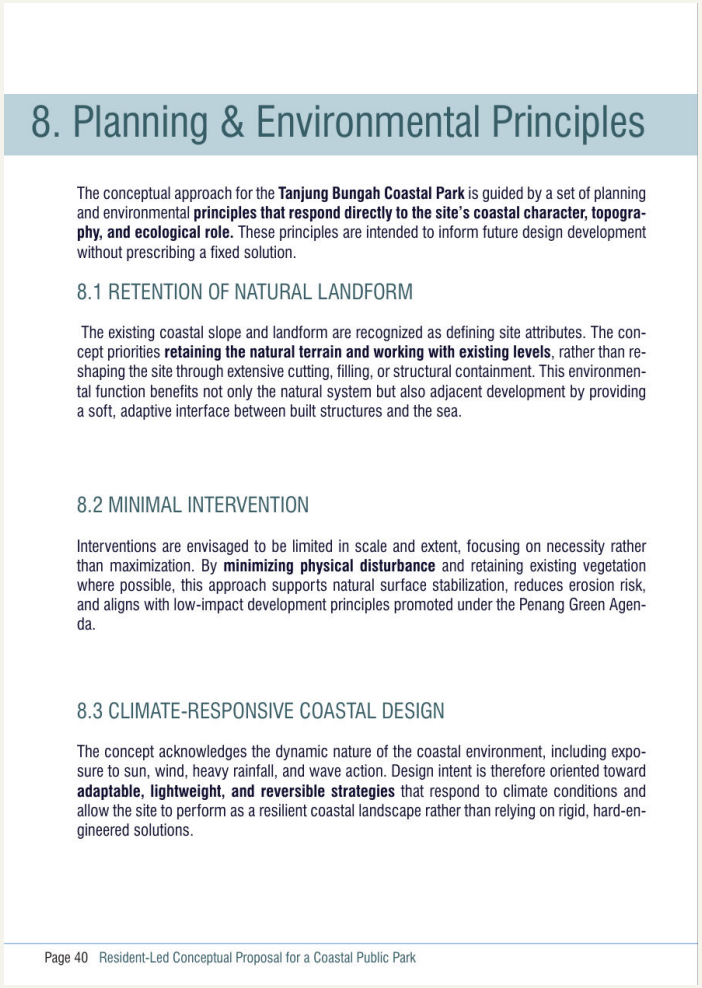
海堤维护成本高，在严酷海洋环境中容易劣化，也容易遭受人为破坏。

在生态层面，海堤形成一条"死海岸"：硬质边缘对海岸动植物几乎没有、甚至完全没有栖息地价值。长远而言，这些影响削弱环境品质及公共利益，同时使主管部门长期承担维护成本。

直接设于海岸线的基础设施，本身就有高昂维护成本，并在极端天气事件中极易受损或失效。持续暴露于海水、波浪冲击及潮汐作用，会加速材料劣化，增加结构损坏、反复修复及最终拆除的风险。

照片：沙滩变窄，令高潮时可退避空间减少，增加公众健康与安全风险。沙滩使用者可能被困在上涨海水与硬质结构之间，避开波浪冲击的能力有限。槟城，2025年。

照片：靠近海岸线兴建的基础设施绝非一次性投资；持续维护，以及修复波浪和极端天气造成的损坏，会带来高昂的长期成本。



8. Planning & Environmental Principles

The conceptual approach for the **Tanjung Bungah Coastal Park** is guided by a set of planning and environmental **principles that respond directly to the site's coastal character, topography, and ecological role.** These principles are intended to inform future design development without prescribing a fixed solution.

8.1 RETENTION OF NATURAL LANDFORM

The existing coastal slope and landform are recognized as defining site attributes. The concept priorities **retaining the natural terrain and working with existing levels**, rather than reshaping the site through extensive cutting, filling, or structural containment. This environmental function benefits not only the natural system but also adjacent development by providing a soft, adaptive interface between built structures and the sea.

8.2 MINIMAL INTERVENTION

Interventions are envisaged to be limited in scale and extent, focusing on necessity rather than maximization. By **minimizing physical disturbance** and retaining existing vegetation where possible, this approach supports natural surface stabilization, reduces erosion risk, and aligns with low-impact development principles promoted under the Penang Green Agenda.

8.3 CLIMATE-RESPONSIVE COASTAL DESIGN

The concept acknowledges the dynamic nature of the coastal environment, including exposure to sun, wind, heavy rainfall, and wave action. Design intent is therefore oriented toward **adaptable, lightweight, and reversible strategies** that respond to climate conditions and allow the site to perform as a resilient coastal landscape rather than relying on rigid, hard-engineered solutions.

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居民主导的公共海岸公园概念建议书

8. 规划与环境原则

丹绒武雅海岸公园的概念方式，由一组直接回应场地海岸特色、地形及生态作用的规划与环境原则引导。这些原则旨在为未来设计深化提供依据，而非规定固定方案。

8.2 最小限度干预

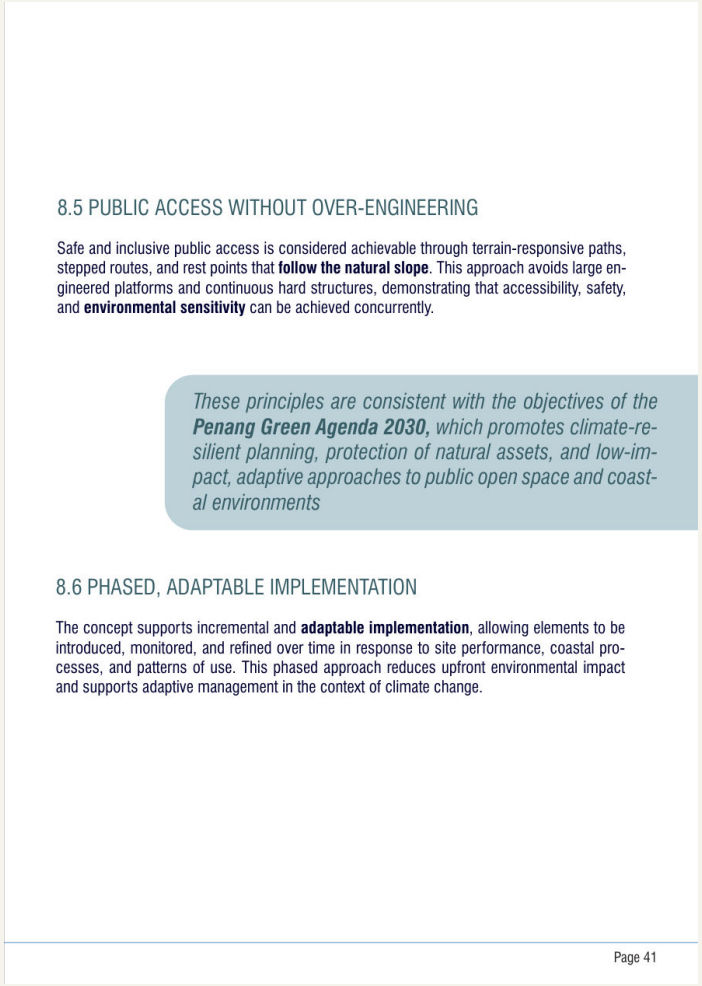
拟议干预在规模及范围上均保持有限，关注必要性，而非追求最大化。通过尽量减少实体扰动，并尽可能保留现有植被，这一方式支持天然地表稳定、降低侵蚀风险，也符合《槟城绿色议程》倡导的低影响发展原则。

8.3 顺应气候的海岸设计

概念认识到海岸环境的动态性质，包括日晒、风、强降雨及波浪作用。因此，设计意图倾向于可调整、轻量及可逆的策略，回应气候条件，让场地成为具韧性的海岸景观，而非依赖僵硬的硬质工程方案。

8.1 保留自然地貌

现有沿海斜坡及地形被视为定义场地的关键特征。概念优先保留自然地形、利用既有高差，而非通过大范围挖削、填土或结构性围挡重新塑造场地。这项环境功能不仅有益于自然系统，也通过在建筑与海洋之间提供柔性、可适应的交界，惠及邻近发展项目。



8.5 PUBLIC ACCESS WITHOUT OVER-ENGINEERING

Safe and inclusive public access is considered achievable through terrain-responsive paths, stepped routes, and rest points that **follow the natural slope**. This approach avoids large engineered platforms and continuous hard structures, demonstrating that accessibility, safety, and **environmental sensitivity** can be achieved concurrently.

*These principles are consistent with the objectives of the **Penang Green Agenda 2030**, which promotes climate-resilient planning, protection of natural assets, and low-impact, adaptive approaches to public open space and coastal environments*

8.6 PHASED, ADAPTABLE IMPLEMENTATION

The concept supports incremental and **adaptable implementation**, allowing elements to be introduced, monitored, and refined over time in response to site performance, coastal processes, and patterns of use. This phased approach reduces upfront environmental impact and supports adaptive management in the context of climate change.

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8.5 无须过度工程化的公众通行

通过顺应自然坡面的步道、阶梯路线及休息点，可实现安全、包容的公众通行。这一方法避免大型工程平台及连续硬质结构，展示通达性、安全性与环境敏感性可以同时实现。

8.6 分阶段、可调整的实施

概念支持渐进及可调整的实施，让各项设施可根据场地表现、海岸过程及使用模式，逐步引入、监测和完善。分期方式可减少初期环境影响，并在气候变化背景下支持适应性管理。

这些原则符合《槟城绿色议程2030》的目标，即推动具气候韧性的规划、保护自然资产，并以低影响、可适应的方式对待公共开放空间及海岸环境。



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居民主导的公共海岸公园概念建议书

一个设计良好的公共公园，始于对地方的尊重。

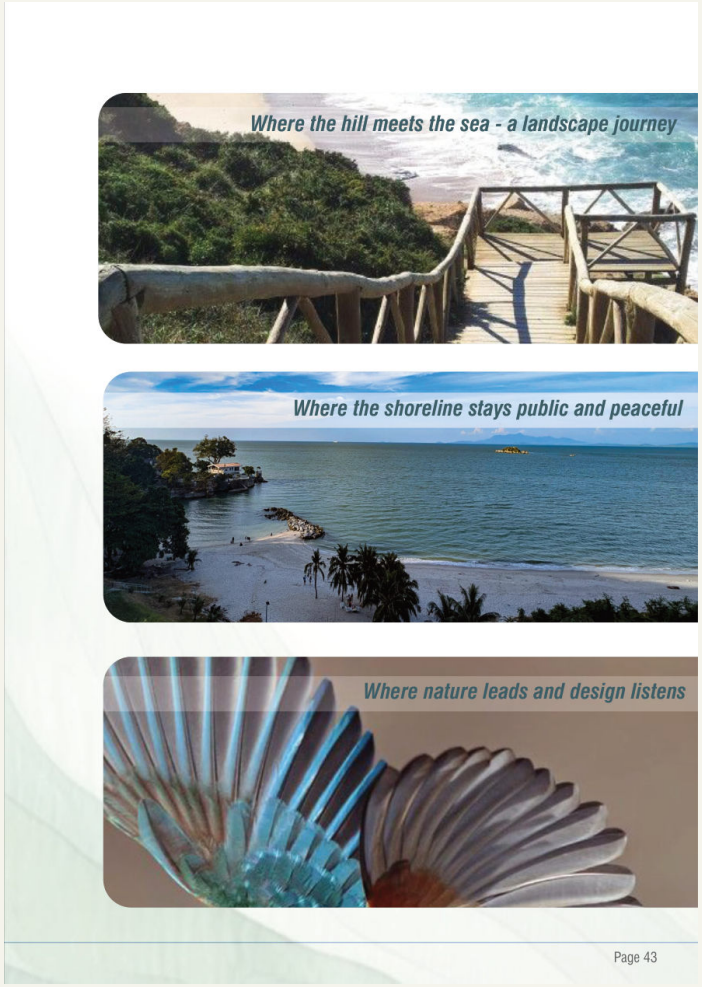
优秀的公园设计顺应自然，而不与自然对抗；它将现有地形、植被及自然过程视为资产，而非限制。

它在已有基础上提升价值，不以失去原有事物为代价，并审慎回应场地及更广泛周边环境的独特性。

同时，它始终以人为本，确保安全、舒适、通达和愉悦等基本需要得到满足，避免过度投入或过度设计。

成功的公园无须昂贵或宏伟；它们往往简洁，却绝不草率。克制、清晰及以景观为主导的思考，往往带来最有力的成果。

最重要的是，一个有意义的公园应体现自身身份：不以成为另一个迪拜或新加坡为目标，而是真正属于丹绒武雅。



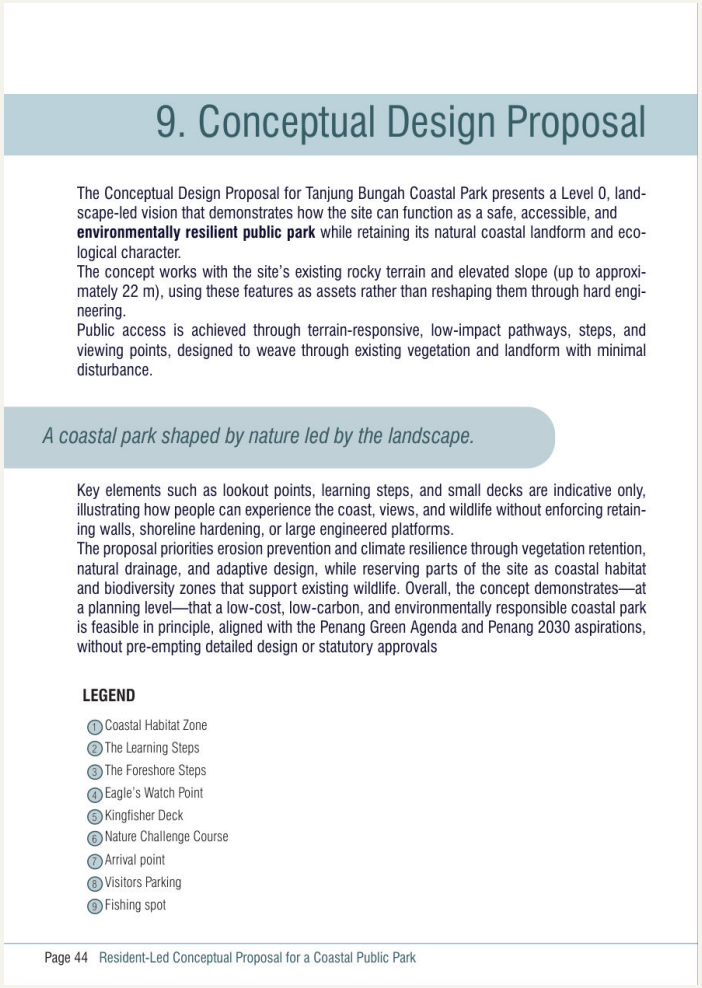
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山与海交会之处——一段景观旅程

让海岸保持公共与宁静

让自然引领，让设计倾听



9. Conceptual Design Proposal

The Conceptual Design Proposal for Tanjung Bungah Coastal Park presents a Level 0, landscape-led vision that demonstrates how the site can function as a safe, accessible, and **environmentally resilient public park** while retaining its natural coastal landform and ecological character.
The concept works with the site's existing rocky terrain and elevated slope (up to approximately 22 m), using these features as assets rather than reshaping them through hard engineering.
Public access is achieved through terrain-responsive, low-impact pathways, steps, and viewing points, designed to weave through existing vegetation and landform with minimal disturbance.

A coastal park shaped by nature led by the landscape.

Key elements such as lookout points, learning steps, and small decks are indicative only, illustrating how people can experience the coast, views, and wildlife without enforcing retaining walls, shoreline hardening, or large engineered platforms.
The proposal priorities erosion prevention and climate resilience through vegetation retention, natural drainage, and adaptive design, while reserving parts of the site as coastal habitat and biodiversity zones that support existing wildlife. Overall, the concept demonstrates—at a planning level—that a low-cost, low-carbon, and environmentally responsible coastal park is feasible in principle, aligned with the Penang Green Agenda and Penang 2030 aspirations, without pre-empting detailed design or statutory approvals

LEGEND

1. Coastal Habitat Zone
2. The Learning Steps
3. The Foreshore Steps
4. Eagle's Watch Point
5. Kingfisher Deck
6. Nature Challenge Course
7. Arrival point
8. Visitors Parking
9. Fishing spot

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居民主导的公共海岸公园概念建议书

9. 概念设计建议

丹绒武雅海岸公园概念设计建议提出一个第0级、以景观为主导的愿景，展示场地如何在保留天然化海岸地形及生态特色的同时，成为安全、可通达且具环境韧性的公共公园。

概念利用场地现有的岩石地形及较高斜坡（最高约22米），将这些特征视为资产，而非通过硬质工程重新塑造。

公众通行通过顺应地形、低影响的步道、阶梯及观景点实现，以最小扰动穿行于现有植被和地形之间。

图例

1 海岸栖息地区

2 探知阶梯

3 滨岸阶梯

4 观鹰台

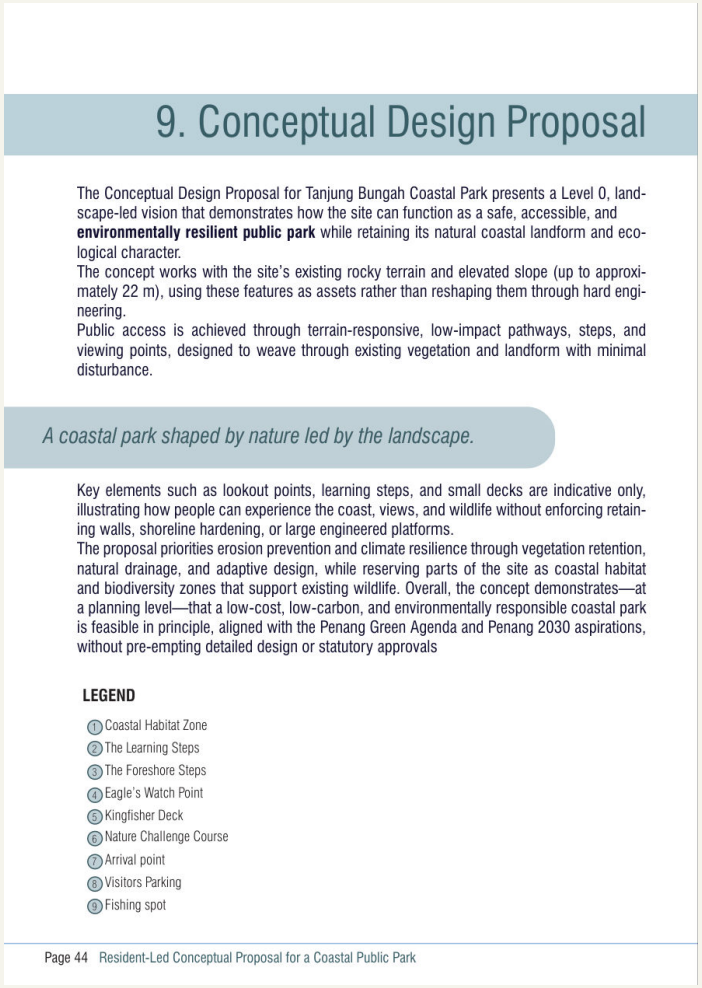
5 翠鸟平台

6 自然挑战路线

7 入口

8 访客停车区

9 垂钓点



9. Conceptual Design Proposal

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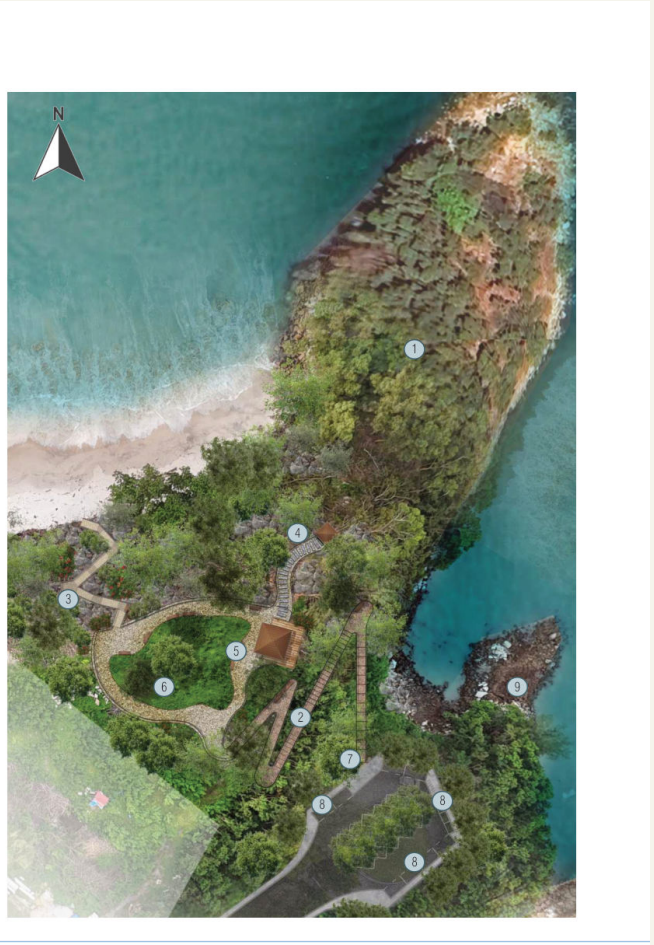
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由自然塑造、由景观引领的海岸公园。

观景点、探知阶梯及小平台等关键元素均仅属示意，说明人们如何在不必设置挡土墙、硬化海岸或建造大型工程平台的情况下，体验海岸、景观及野生动物。

建议书通过保留植被、天然排水及适应性设计，优先考虑侵蚀预防与气候韧性，同时将部分场地保留为海岸栖息地及生物多样性区域，支持现有野生动物。整体而言，概念在规划层面展示：低成本、低碳、对环境负责任的海岸公园原则上可行，并符合《槟城绿色议程》及《槟城2030》愿景，而不预先决定详细设计或法定审批。

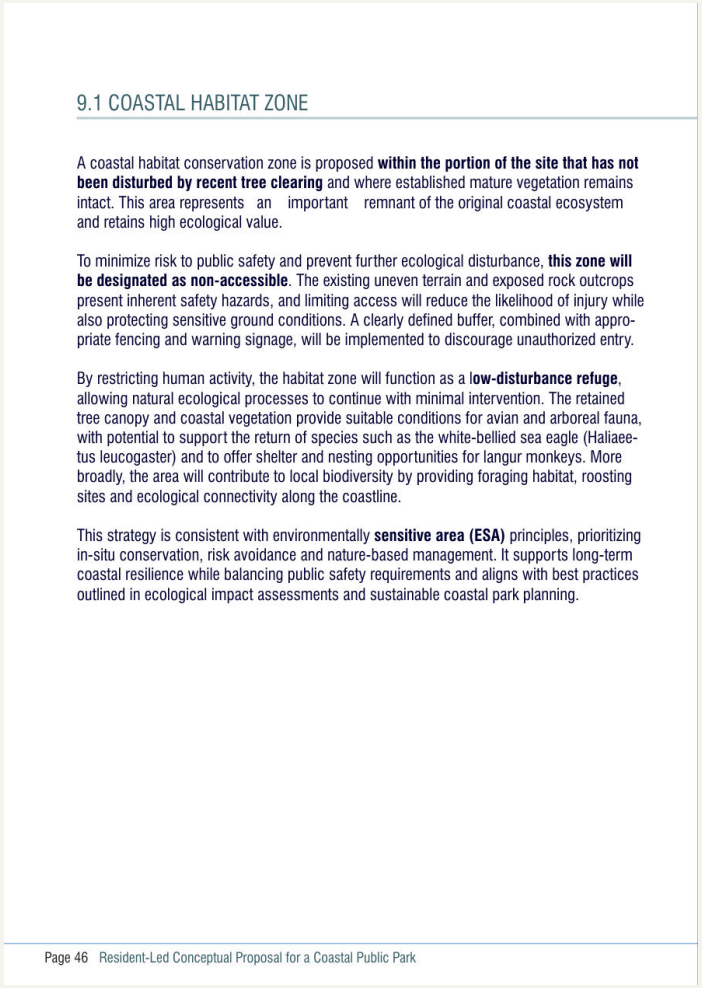


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9.1 COASTAL HABITAT ZONE

A coastal habitat conservation zone is proposed **within the portion of the site that has not been disturbed by recent tree clearing** and where established mature vegetation remains intact. This area represents an important remnant of the original coastal ecosystem and retains high ecological value.

To minimize risk to public safety and prevent further ecological disturbance, **this zone will be designated as non-accessible**. The existing uneven terrain and exposed rock outcrops present inherent safety hazards, and limiting access will reduce the likelihood of injury while also protecting sensitive ground conditions. A clearly defined buffer, combined with appropriate fencing and warning signage, will be implemented to discourage unauthorized entry.

By restricting human activity, the habitat zone will function as a l**ow-disturbance refuge**, allowing natural ecological processes to continue with minimal intervention. The retained tree canopy and coastal vegetation provide suitable conditions for avian and arboreal fauna, with potential to support the return of species such as the white-bellied sea eagle (Haliaeetus leucogaster) and to offer shelter and nesting opportunities for langur monkeys. More broadly, the area will contribute to local biodiversity by providing foraging habitat, roosting sites and ecological connectivity along the coastline.

This strategy is consistent with environmentally **sensitive area (ESA)** principles, prioritizing in-situ conservation, risk avoidance and nature-based management. It supports long-term coastal resilience while balancing public safety requirements and aligns with best practices outlined in ecological impact assessments and sustainable coastal park planning.

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居民主导的公共海岸公园概念建议书

9.1 海岸栖息地区

建议在近期树木清除未曾扰动、成熟植被仍完整保留的部分场地设置海岸栖息地保育区。该区域是原有海岸生态系统的重要残存部分，仍具有较高生态价值。

为尽量降低公众安全风险，并避免进一步生态扰动，该区域将划为不开放通行区。现有高低不平的地形及裸露岩石本身具有安全隐患，限制进入可降低受伤可能，同时保护敏感的地表条件。将设置界线清晰的缓冲区，并配合适当围栏及警示标牌，防止未经允许进入。

通过限制人类活动，栖息地区将成为低干扰的庇护所，让自然生态过程以最小干预继续进行。保留的树冠及海岸植被，为鸟类及树栖动物提供适宜条件，有望支持白腹海雕（Haliaeetus leucogaster）等物种返回，也为叶猴提供庇护及筑居机会。更广泛而言，该区域可通过提供觅食栖息地、夜栖地点及沿岸生态联系，促进地方生物多样性。

这一策略符合环境敏感区（ESA）原则，优先考虑原地保育、风险规避及以自然为本的管理。在兼顾公众安全要求的同时支持长期海岸韧性，并符合生态影响评估与可持续海岸公园规划所提出的良好做法。

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9.2 THE LEARNING STEPS

Learning Steps provide a simple and intuitive means of access to the upper part of the hill. They are conceived as lightweight, low-impact elements, constructed from timber or a timber-and-earth combination, and aligned as closely as possible with the natural contour lines to minimize ground disturbance and avoid the need for heavy construction.

The design intent includes safe handrails and, where feasible, ramp-like alternatives or gentler gradients to support inclusive use by people with mobility impairments, parents with prams, children, and elderly visitors. An intermediate landing at approximately +6 m is envisaged as an accessible terrace, offering a resting and viewing space that can be reached more easily by users with limited mobility. In this way, the Learning Steps demonstrate how the park can remain natural in character while being inclusive and socially accessible.

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居民主导的公共海岸公园概念建议书

9.2 探知阶梯

探知阶梯以简单、直观的方式通往小山较高处。设计构想为轻量、低影响的构件，以木材或木材与土体结合建造，并尽量沿天然等高线布置，以减少地面扰动，避免重型施工。

设计意图包括安全扶手，并在可行处提供类似坡道的替代路径或较缓坡度，方便行动不便者、推婴儿车的家长、儿童及年长访客使用。设想在约+6米高度设置中途平台，作为无障碍观景露台，让行动能力有限的使用者较容易抵达、休息和观景。通过这种方式，探知阶梯展示公园如何兼顾自然特色与包容、人人可享的使用体验。

图例

1 无障碍坡道

2 无障碍观景点

3 教育元素

图中重复编号：1、1、1、1；2、2；3、3、3、3、3、3、3。

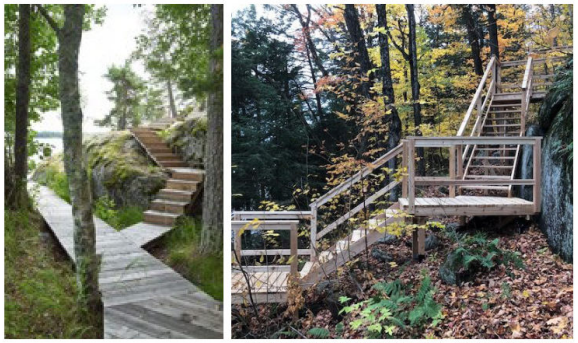


Photo: Nature-based paths provide safe, low-impact access along natural slopes without intrusive construction.



Photo: Example of different types of natural steps are possible. Final detailing can be adapted to respond to site conditions and address specific needs in the most appropriate way.

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照片：以自然为本的路径，在天然斜坡上提供安全、低影响的通行方式，无须侵入性的施工。

照片：可采用不同类型的自然阶梯。最终细节可根据场地条件调整，以最适当的方式回应具体需要。

In addition, the **Learning Steps** may be complemented by a simple **educational program** for children, introducing **coastal ecology, local wildlife, and environmental processes** in an engaging and informal way. This approach supports learning through play and observation, encouraging awareness of the coastal environment while reinforcing the park's educational value.

Any learning elements are envisaged as l**ow-cost, durable installations made from natural materials, consistent with the park's landscape character and low-impact design principles.** The content and format of the educational program would be developed in collaboration with **local environmental groups**, with input from relevant government agencies to ensure accuracy, appropriateness, and alignment with broader environmental education objectives.



Photo: Example of low-cost, simple play–learn elements that are a well-established way to enrich park experiences for both adults and children, supporting informal learning about the local environment.

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此外，探知阶梯可配合简单的儿童教育活动，以生动、非正式的方式介绍海岸生态、当地野生动物及环境过程。这一方法支持通过游戏及观察学习，增进对海岸环境的认识，并强化公园的教育价值。

学习元素拟采用天然材料，制成低成本、耐用的设施，与公园景观特色及低影响设计原则一致。教育活动的内容及形式将与当地环保组织合作开发，并征询相关政府机构意见，确保准确、适宜，并与更广泛的环境教育目标一致。

照片：低成本、简单的游玩与学习元素示例。这是丰富成人及儿童公园体验的成熟方式，支持对当地环境的非正式学习。



Local Environmental Groups (Penang, Malaysia)

Friends of Penang Botanic Gardens (FoPBG)
Strong in environmental education, nature walks, and school engagement. While forest-focused, they have experience translating ecology into child-friendly learning and could advise on program structure and interpretation.

Penang Green Council
A key state-linked organization supporting sustainability education, community programs, and public awareness. Well positioned to help align content with Penang 2030 goals and broader environmental messaging.

Centre for Marine and Coastal Studies (CEMACS)
Based at Universiti Sains Malaysia (USM), CEMACS specialists in marine and coastal ecology, including shoreline processes, intertidal life, and coastal conservation. Ideal for ensuring scientific accuracy in coastal and marine topics.

Water Watch Penang
Experienced in public education related to rivers, water quality, and coastal pollution. They frequently work with communities and schools and are well suited to hands-on, observation-based learning.

Langur Project Penang (LPP)
The educational program focuses on wildlife conservation, education, and community engagement in Penang. Although best known for its work with dusky leaf monkeys (Trachypithecus obscurus), its programs also promote broader wildlife awareness, habitat protection, and responsible human-nature coexistence — all of which align well with a coastal ecology education initiative.

Entopia by Penang Butterfly Farm
A locally based environmental education center with strong experience in hands-on learning for children, specializing in insects, life cycles, and ecosystem awareness through simple, engaging interpretation.

The Habitat Penang Hill
A conservation-led nature park recognized for its low-impact access design and educational programs that promote biodiversity awareness and respect for sensitive landscapes.

Tropical Spice Garden
A community-oriented environmental attraction focused on plants, ecology, and cultural landscapes, with extensive experience in informal, sensory-based learning using natural materials.

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当地环保组织（马来西亚槟城）

槟城植物园之友（Friends of Penang Botanic Gardens，FoPBG）

擅长环境教育、自然导览及学校参与。虽然重点在森林，但具备将生态知识转化为儿童易懂学习内容的经验，可就活动结构及解说提供建议。

槟城绿色机构（Penang Green Council）

与州政府相关的重要组织，支持可持续发展教育、社区计划及公众意识提升。适合协助内容与《槟城2030》目标及更广泛环保信息保持一致。

海洋与海岸研究中心（Centre for Marine and Coastal Studies，CEMACS）

设于马来西亚理科大学（USM），专长为海洋及海岸生态，包括海岸过程、潮间带生命及海岸保育。适合协助确保海岸与海洋主题的科学准确性。

槟城水源监督机构（Water Watch Penang）

在河流、水质及海岸污染相关公众教育方面经验丰富，经常与社区及学校合作，适合实践性、以观察为本的学习。

槟城叶猴保育计划（Langur Project Penang，LPP）

其教育活动专注槟城的野生动物保育、教育及社区参与。虽然以暗色叶猴（Trachypithecus obscurus）工作最为人熟悉，但活动也推动更广泛的野生动物意识、栖息地保护及负责任的人与自然共存，均与海岸生态教育倡议十分契合。

槟城蝴蝶园Entopia

本地环境教育中心，在儿童动手学习方面经验丰富，擅长以简单、生动的解说介绍昆虫、生命周期及生态系统意识。

Local Environmental Groups (Penang, Malaysia)

Friends of Penang Botanic Gardens (FoPBG)
Strong in environmental education, nature walks, and school engagement. While forest-focused, they have experience translating ecology into child-friendly learning and could advise on program structure and interpretation.

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升旗山The Habitat

以保育为核心的自然公园，以低影响通行设计及教育活动著称，推广生物多样性意识及对敏感景观的尊重。

热带香料园（Tropical Spice Garden）

面向社区的环保景点，专注植物、生态及文化景观，拥有以天然材料开展非正式、感官式学习的丰富经验。

9.3 FORESHORE STEPS

The foreshore steps are designed with a different character from the learning steps. As they provide direct access to the beach, they are not intended to accommodate wheelchair users due to the natural constraints of the terrain.

The timber structure is designed to lightly span above the ground, allowing existing and proposed vegetation to grow beneath and around it with minimal disturbance. Resting platforms are provided at appropriate intervals along the route and also function as viewing points towards the sea. These areas are equipped with benches and benefit from shade provided by strategically placed vegetation.



LEGEND
① Steps
② Landing with a viewing platform

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9.3 滨岸阶梯

滨岸阶梯的设计特色有别于探知阶梯。由于直接通往沙滩，且受天然地形限制，这条路线不计划供轮椅使用者通行。

木结构轻轻跨越地面，让现有及拟种植被在其下方及周边生长，尽量减少扰动。沿线在适当间距设置休息平台，同时作为面向海洋的观景点。这些区域配置座椅，并利用策略性种植的植被提供遮荫。

图例

1 阶梯

2 带观景平台的中途平台

图中重复编号：1、1、1、1、1；2、2、2、2。

完整阅读译本 · 图纸与技术细节请参阅英文原件。

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完整阅读译本 · 图纸与技术细节请参阅英文原件。

9.4 EAGLE'S WATCH POINT

The Eagle Watch Point is conceived as a discreet lookout platform for birdwatchers and nature enthusiasts, providing a safe and carefully positioned location from which to observe wildlife. The structure is set within the coastal habitat zone and is accessed via a narrow path of stepping stones to minimize ground disturbance.

The lookout is intentionally screened and visually unobtrusive, allowing visitors to observe wildlife without causing disruption.



LEGEND

① Eagle's Watch Point

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9.4 观鹰台

观鹰台构想为供观鸟者及自然爱好者使用的低调观景平台，以安全、审慎选定的位置观察野生动物。结构位于海岸栖息地区内，经一条窄小的踏石路径进入，以尽量减少地面扰动。

观景台刻意设置遮蔽，外观不显眼，让访客能够观察野生动物而不造成干扰。

图例

1 观鹰台

图中编号：1。



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设计灵感来自场地的文化传承，参考传统渔民编织鱼篓的形态与工艺。这一方式形成细腻、含蓄的建筑语言，与景观融合，同时向地方历史致意，并彰显传统手艺。

9.5 KINGFISHER DECK

The second pavilion has a distinct character and is located at the heart of the park. It is conceived as a breezy shelter that can function as a resting place or informal picnic spot. The pavilion/deck overlooks the central lawn and children's play area, while also offering views across the surrounding landscape.

The design concept may draw inspiration from local craftsmanship, particularly the woven forms of traditional baskets, as well as from the elegant wing patterns of the kingfisher, a bird commonly found in the area and the namesake of the pavilion. These references help root the structure in local culture and ecology while maintaining a lightweight, nature-responsive character.



LEGEND

① Kingfisher Deck

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9.5 翠鸟平台

第二座亭子具有独特特色，位于公园中心。

它被设想为一处通风凉爽的庇荫空间，可供休息或非正式野餐。亭子 / 平台俯瞰中央草坪及儿童游乐区，同时提供周边景观视野。

设计概念可从本地手艺汲取灵感，尤其是传统篮子的编织形态，以及翠鸟优雅的翼部纹样；翠鸟在当地常见，也是亭子名称的由来。这些参考让结构扎根于地方文化及生态，同时维持轻量、顺应自然的特色。

图例

1 翠鸟平台

图中编号：1。

完整阅读译本 · 图纸与技术细节请参阅英文原件。



Photo: Biophilic design uses natural materials and forms inspired by nature, blending gently into the park.



Photo: Liang Hin Rattan Shop (102 years old), run by third-generation craftsman Mr. Chow. Traditional rattan craftsmanship offers opportunities to integrate local heritage and skills into the park.

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照片：拥有102年历史的Liang Hin藤器店，由第三代匠人周先生经营。传统藤编工艺为将本地文化传承及技能融入公园提供机会。

照片：亲生物设计采用天然材料及源于自然的形态，柔和地融入公园。

9.6 NATURE CHALLENGE COURSE

The children's playground and obstacle course are conceived as a **nature-based play** environment, integrated into the existing topography and shaped by it.
Using natural materials such as timber, driftwood, stones, and earth, the design avoids over-elaboration and instead leaves space for **imagination, exploration, and self-directed play**.
This approach reflects a well-established **international trend in playground design**, where natural play landscapes are valued for supporting physical development, creativity, risk awareness, and connection to nature.
By working with slopes, level changes, and existing landforms, the playground becomes an organic part of the park rather than an imposed structure.



LEGEND
① Nature Challenge Course

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9.6 自然挑战路线

儿童游乐场及障碍路线构想为以自然为本的游玩环境，融入现有地形，并由地形塑造。

设计使用木材、漂流木、石头及泥土等天然材料，避免过度加工，为想象、探索及自主游戏留下空间。

这一方式呼应游乐场设计中已成熟的国际趋势：自然游玩景观因能支持身体发展、创造力、风险意识及与自然的联系而受到重视。

通过利用斜坡、高差及现有地形，游乐场成为公园有机的一部分，而非强加其上的结构。

图例

1 自然挑战路线

图中编号：1。



Photo: Nature-based playgrounds are increasingly popular in Asia, using natural materials and forms that blend with the landscape and encourage imaginative, exploratory play.



Photo: Forest Ramble — Jurong Lake Gardens, Singapore
A large, nature-inspired play garden with log trails, climbing stations, water play and naturalistic features that let children explore like animals in the landscape.



Photo: Coastal PlayGrove Nature Playgarden — East Coast Park, Singapore. A nature play area within a coastal park that includes natural elements like sand, logs, and bamboo for imaginative, landscape-based play.

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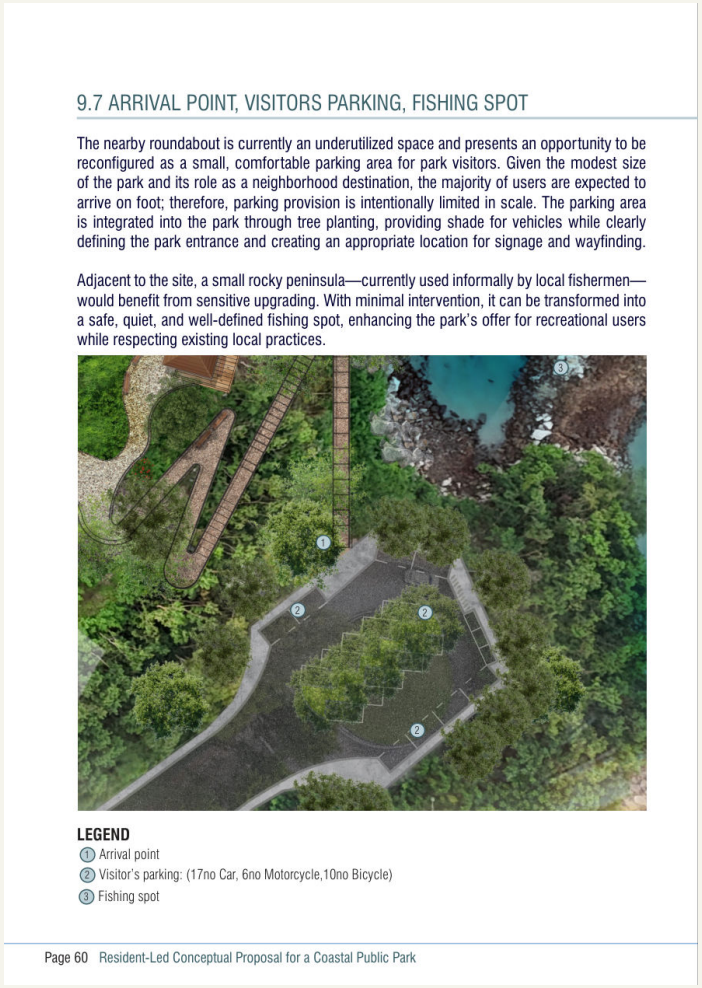
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照片：自然游乐场在亚洲日益普及，采用与景观融合的天然材料及形态，鼓励想象性与探索性的游戏。

照片：Forest Ramble——新加坡裕廊湖花园。一座大型、以自然为灵感的游戏花园，设有原木路线、攀爬点、水上游戏及仿自然元素，让儿童如景观中的动物般探索。

照片：Coastal PlayGrove Nature Playgarden——新加坡东海岸公园。海岸公园内的自然游乐区，包含沙、原木及竹子等天然元素，支持以景观为基础、富想象力的游戏。



9.7 ARRIVAL POINT, VISITORS PARKING, FISHING SPOT

The nearby roundabout is currently an underutilized space and presents an opportunity to be reconfigured as a small, comfortable parking area for park visitors. Given the modest size of the park and its role as a neighborhood destination, the majority of users are expected to arrive on foot; therefore, parking provision is intentionally limited in scale. The parking area is integrated into the park through tree planting, providing shade for vehicles while clearly defining the park entrance and creating an appropriate location for signage and wayfinding.

Adjacent to the site, a small rocky peninsula—currently used informally by local fishermen—would benefit from sensitive upgrading. With minimal intervention, it can be transformed into a safe, quiet, and well-defined fishing spot, enhancing the park's offer for recreational users while respecting existing local practices.

LEGEND

1. Arrival point
2. Visitor's parking: (17no Car, 6no Motorcycle,10no Bicycle)
3. Fishing spot

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9.7 入口、访客停车区及垂钓点

附近的回旋处目前使用不足，可重新规划为小型、舒适的公园访客停车区。考虑到公园规模不大，且作为邻里目的地，预期大多数使用者步行到访，因此停车设施刻意保持小规模。停车区通过植树融入公园，为车辆遮荫，同时明确公园入口，并为标识及导向设施提供合适位置。

毗邻场地的一处小型岩石半岛，目前由当地渔民非正式使用，可受益于审慎改善。通过最小干预，可将其转化为安全、安静、界线清晰的垂钓点，在尊重既有地方习惯的同时，丰富公园对休闲使用者的吸引力。

图例

1 入口

2 访客停车区：17个汽车位、6个摩托车位、10个脚车位

3 垂钓点

图中重复编号：1、1；2、2、2、2；3、3。



Photo: Example of contemporary way-finding signage that informs visitors while fostering a sense of belonging. Site-specific design draws on local heritage and landscape character to reflect the identity of the location.

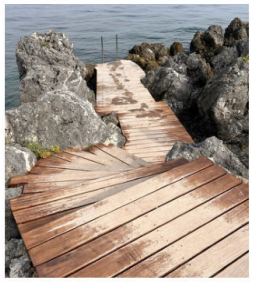


Photo: Beauty in simplicity: a modest and elegant fishing spot, carefully designed to respect its set-ting and spatial footprint.

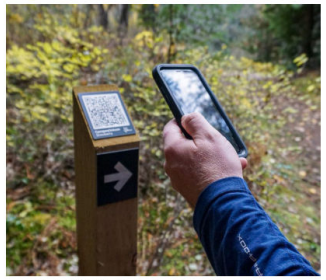


Photo: Digital technologies allow minimal signage to carry layered information. QR codes support wayfinding and offer deeper insights into the park's nature, ecology, and features.



Photo: Currently underutilized space around the existing roundabout that could be easily converted into visitor parking.

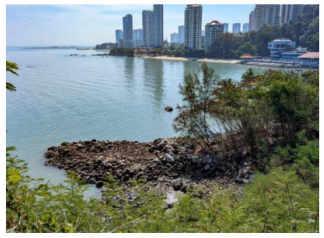


Photo: Existing rocky peninsula used by locals as an informal fishing spot

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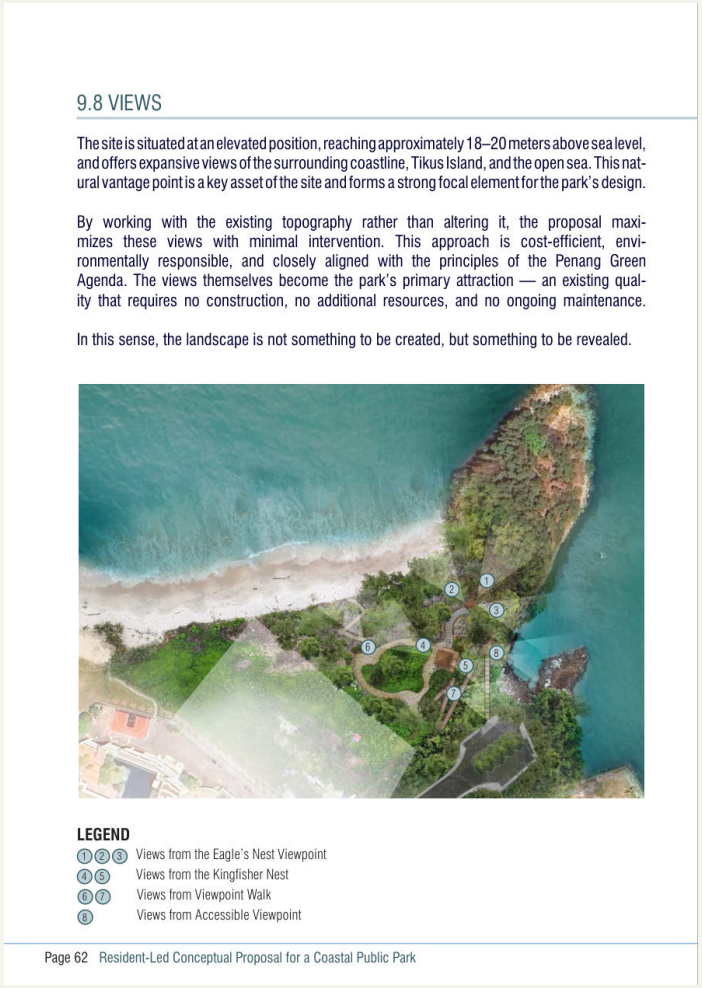
照片：现代导向标识示例，在向访客提供信息的同时，营造归属感。场地专属设计从地方文化传承及景观特色汲取灵感，体现地点身份。

照片：数字技术可让少量标识承载多层次信息。二维码既可协助导向，也可提供对公园自然、生态及特色的深入介绍。

照片：简约之美——朴素而优雅的垂钓点，经过审慎设计，尊重周边环境及空间占地。

照片：现有回旋处周边使用不足的空间，可较容易改为访客停车区。

照片：当地居民用作非正式垂钓点的现有岩石半岛。



9.8 VIEWS

The site is situated at an elevated position, reaching approximately 18–20 meters above sea level, and offers expansive views of the surrounding coastline, Tikus Island, and the open sea. This natural vantage point is a key asset of the site and forms a strong focal element for the park's design.

By working with the existing topography rather than altering it, the proposal maximizes these views with minimal intervention. This approach is cost-efficient, environmentally responsible, and closely aligned with the principles of the Penang Green Agenda. The views themselves become the park's primary attraction — an existing quality that requires no construction, no additional resources, and no ongoing maintenance.

In this sense, the landscape is not something to be created, but something to be revealed.

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9.8 景观视图

场地处于较高位置，海拔约18至20米，可广泛眺望周围海岸、Pulau Tikus小岛及开阔海面。这一天然制高点是场地的重要资产，也是公园设计的强烈焦点。

通过利用而非改变现有地形，建议书以最小干预充分展现这些景观。这一方式具成本效益、对环境负责，并与《槟城绿色议程》的原则紧密一致。景观本身成为公园的主要吸引力：一种已经存在、不需要建造、不消耗额外资源，也无须持续维护的品质。

从这个意义上说，景观不是有待创造的事物，而是有待展现的事物。

图例

从鹰巢观景点望出的景观

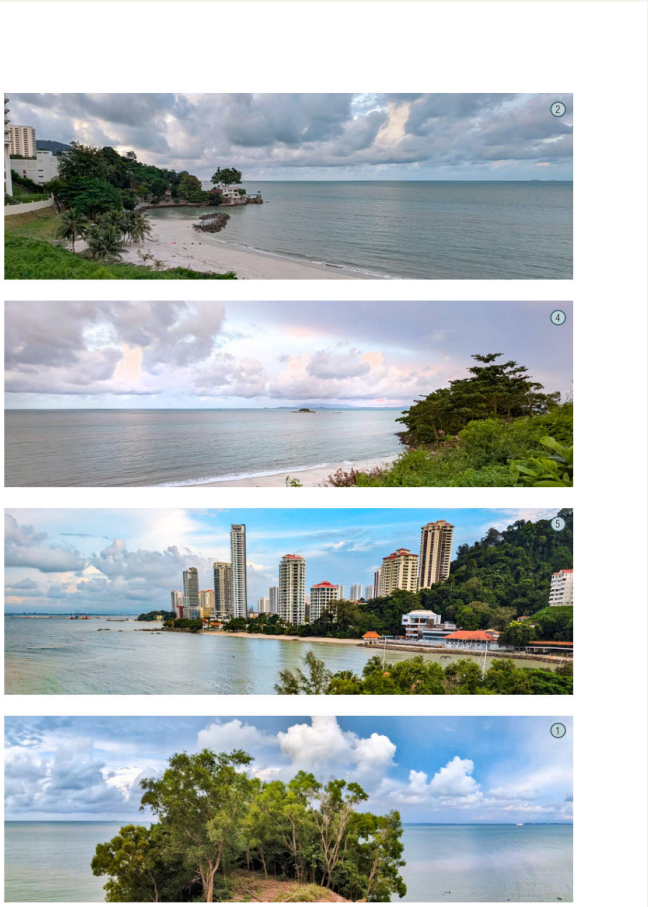
从翠鸟亭望出的景观

从观景步道望出的景观

从无障碍观景点望出的景观

图中编号：1、2、3、4、5、6、7、8。

图中排列编号：1、4、6、8、2、5、7、3。



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图中编号：2、1、4、5。



10. Conceptual Planting Design

10.1 PLANTING PALETTE

The planting design adopts a zoned, **slope-responsive approach** using **native coastal and climate-resilient species** selected for their proven performance in saline, wind-exposed, and free-draining conditions.

Planting is structured across the top, middle, and bottom of the embankment to support slope stabilization and coastal protection functions. **Deep-rooted tree and shrub species contribute to soil reinforcement and surface stabilization** by binding loose substrates and reducing erosion risk, while mid-storey and groundcover species limit surface runoff and improve soil cohesion. At the foreshore, **salt-tolerant dune and pioneer species** provide natural buffering against wind, wave action, and sand movement, supporting beach stability.

Existing vegetation that has naturally regenerated following previous clearing is retained and incorporated into the planting framework wherever feasible. Supplementary planting is introduced selectively to strengthen ecological continuity, address gaps in slope coverage, and enhance long-term resilience. This incremental, site-responsive approach minimizes disturbance, reduces establishment costs, and results in a robust, low-maintenance landscape system appropriate for long-term management and future climatic conditions.

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居民主导的公共海岸公园概念建议书

10. 概念种植设计

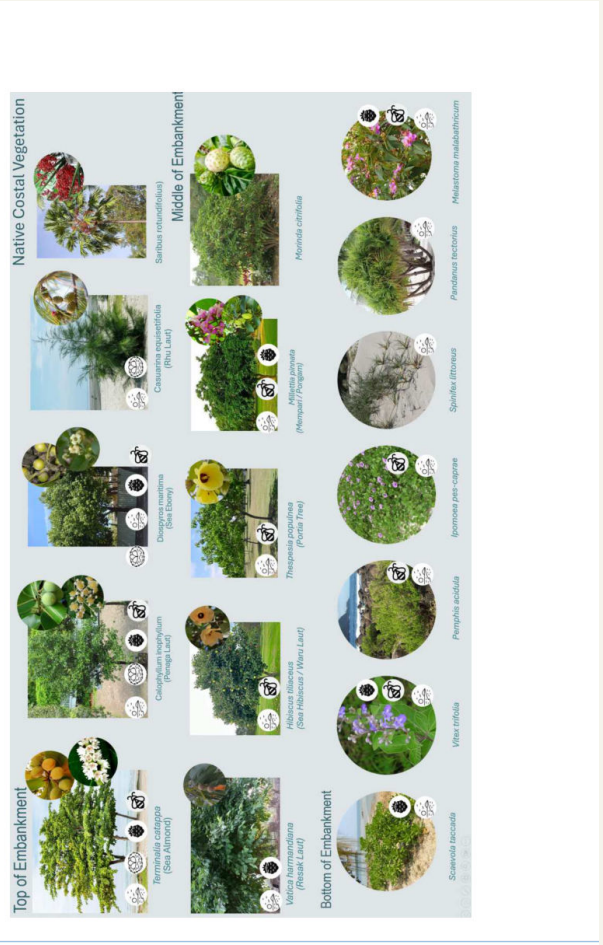
种植设计采用分区、顺应坡面的方式，选用本土海岸及具气候韧性的物种，其在盐分环境、强风暴露及排水良好条件下的表现已有实证。

种植沿坡顶、中坡及坡脚分层布置，支持边坡稳定及海岸保护功能。深根乔木与灌木可固结松散基质、降低侵蚀风险，从而加固土壤及稳固地表；中层植物与地被则限制地表径流并改善土壤凝聚力。在滨岸，耐盐沙丘植物及先锋物种提供天然缓冲，抵御风、波浪及沙粒移动，支持沙滩稳定。

过去清理后自然再生的现有植被，将在可行处保留并纳入种植框架。有选择地补植，以强化生态连续性、填补坡面覆盖空缺，并提升长期韧性。这一渐进、回应场地条件的方式，可尽量减少扰动、降低植栽建立成本，并形成稳健、低维护的景观系统，适合长期管理及未来气候条件。

照片：清理五个月后，植被强劲再生，新绿及先锋物种正自然地重新稳定坡面覆盖。

10.1 植物配置



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本土海岸植被

坡顶

- 榄仁树 Terminalia catappa（Sea Almond）
- 红厚壳 Calophyllum inophyllum（Penaga Laut）
- Diospyros maritima（Sea Ebony）
- 木麻黄 Casuarina equisetifolia（Rhu Laut）
- Saribus rotundifolius

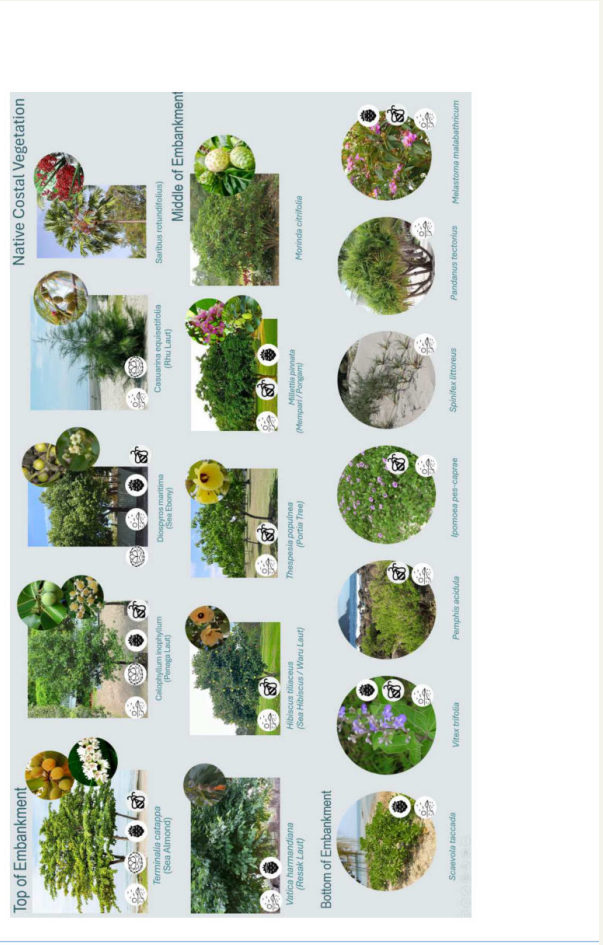
中坡

- Vatica harmandiana（Resak Laut）
- 黄槿 Hibiscus tiliaceus（Sea Hibiscus / Waru Laut）
- Thespesia populnea（Portia Tree）
- 水黄皮 Millettia pinnata（Mempari / Pongam）
- 诺丽 Morinda citrifolia

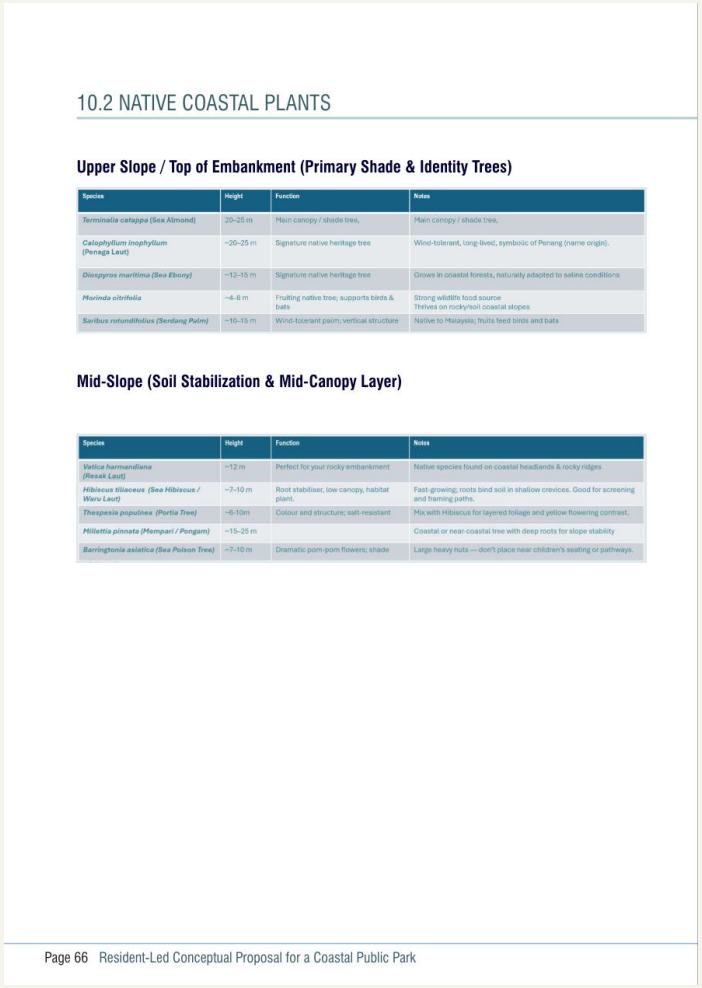
坡脚

- 草海桐 Scaevola taccada
- 三叶蔓荆 Vitex trifolia
- 水芫花 Pemphis acidula
- 马鞍藤 Ipomoea pes-caprae
- 滨刺麦 Spinifex littoreus

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- 露兜树 Pandanus tectorius
- 野牡丹 Melastoma malabathricum



10.2 NATIVE COASTAL PLANTS

Upper Slope / Top of Embankment (Primary Shade & Identity Trees)

Species	Height	Function	Notes
Terminalia catappa (Sea Almond)	20–25 m	Main canopy / shade tree,	Main canopy / shade tree,
Calophyllum inophyllum (Penaga Laut)	~20–25 m	Signature native heritage tree	Wind-tolerant, long-lived, symbolic of Penang (name origin).
Diospyros maritima (Sea Ebony)	~12–15 m	Signature native heritage tree	Grows in coastal forests, naturally adapted to saline conditions
Morinda citrifolia	~4–8 m	Fruiting native tree; supports birds & bats	Strong wildlife food source Thrives on rocky/soil coastal slopes
Saribus rotundifolius (Serdang Palm)	~10–15 m	Wind-tolerant palm; vertical structure	Native to Malaysia; fruits feed birds and bats

Mid-Slope (Soil Stabilization & Mid-Canopy Layer)

Species	Height	Function	Notes
Vatica harmandiana (Resak Laut)	~12 m	Perfect for your rocky embankment	Native species found on coastal headlands & rocky ridges
Hibiscus tiliaceus (Sea Hibiscus / Waru Laut)	~7–10 m	Root stabiliser, low canopy, habitat plant.	Fast-growing; roots bind soil in shallow crevices. Good for screening and framing paths.
Thespesia populnea (Portia Tree)	~6-10m	Colour and structure; salt-resistant	Mix with Hibiscus for layered foliage and yellow flowering contrast.
Millettia pinnata (Mempari / Pongam)	~15–25 m		Coastal or near-coastal tree with deep roots for slope stability
Barringtonia asiatica (Sea Poison Tree)	~7–10 m	Dramatic pom-pom flowers; shade	Large heavy nuts — don't place near children's seating or pathways.

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10.2 本土海岸植物

上坡 / 坡顶（主要遮荫及特色乔木）

表格栏目：物种 | 高度 | 功能 | 备注

Terminalia catappa（榄仁树 / Sea Almond）

高度：20–25米。功能：主要树冠 / 遮荫乔木。备注：主要树冠 / 遮荫乔木。

Calophyllum inophyllum（红厚壳 / Penaga Laut）

高度：约20–25米。功能：具代表性的本土传统树种。备注：耐风、长寿，象征槟城（名称来源）。

Diospyros maritima（Sea Ebony）

高度：约12–15米。功能：具代表性的本土传统树种。备注：生长于海岸森林，自然适应盐分环境。

Morinda citrifolia（诺丽）

高度：约4–8米。功能：本土结果乔木，支持鸟类及蝙蝠。备注：重要野生动物食物来源；适于岩石 / 土质海岸斜坡生长。

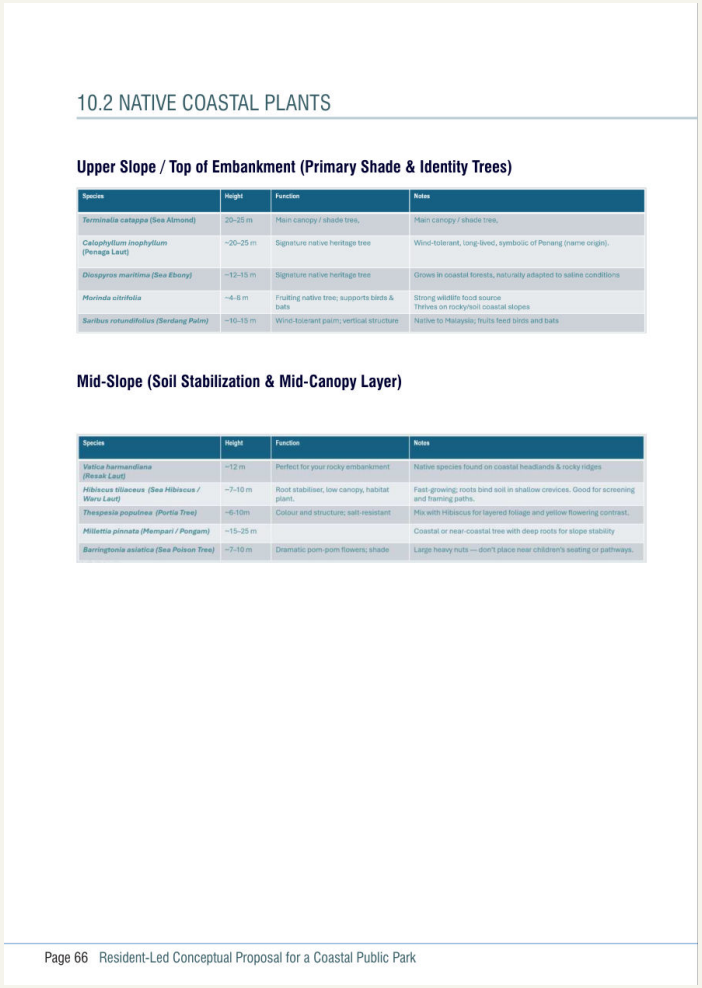
Saribus rotundifolius（Serdang棕榈）

高度：约10–15米。功能：耐风棕榈；提供垂直景观结构。备注：马来西亚原生植物，果实供鸟类及蝙蝠食用。

中坡（土壤稳定及中层树冠）

表格栏目：物种 | 高度 | 功能 | 备注

Vatica harmandiana（Resak Laut）



10.2 NATIVE COASTAL PLANTS

Upper Slope / Top of Embankment (Primary Shade & Identity Trees)

Species	Height	Function	Notes
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Mid-Slope (Soil Stabilization & Mid-Canopy Layer)

Species	Height	Function	Notes
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Thespesia populnea (Portia Tree)	~6-10m	Colour and structure; salt-resistant	Mix with Hibiscus for layered foliage and yellow flowering contrast.
Millettia pinnata (Mempari / Pongam)	~15–25 m		Coastal or near-coastal tree with deep roots for slope stability
Barringtonia asiatica (Sea Poison Tree)	~7–10 m	Dramatic pom-pom flowers; shade	Large heavy nuts — don't place near children's seating or pathways.

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高度：约12米。功能：非常适合此处岩石坡面。备注：原生于海岸岬角及岩石山脊的物种。

Hibiscus tiliaceus（黄槿 / Sea Hibiscus / Waru Laut）

高度：约7–10米。功能：根系稳土、低树冠、栖息地植物。备注：生长快；根系可固结浅岩缝中的土壤，适合遮挡及界定路径。

Thespesia populnea（Portia Tree）

高度：约6–10米。功能：提供色彩与结构；耐盐。备注：与黄槿搭配，形成层次丰富的叶丛与黄色花朵对比。

Millettia pinnata（水黄皮 / Mempari / Pongam）

高度：约15–25米。功能栏原文留空。备注：沿海或近海乔木，深根有助于边坡稳定。

Barringtonia asiatica（玉蕊 / Sea Poison Tree）

高度：约7–10米。功能：醒目的绒球状花朵；遮荫。备注：果实大而重，不应种在儿童座椅或步道附近。

Toe of Embankment / Windbreak Line (Salt-Spray Tolerant & Structural)

Species	Height	Function	Notes
Casuarina equisetifolia (Rhu Laut)	~8-12m	Windbreak, erosion control	Plant at 2–3 m offset from beach edge to avoid root exposure. Provides roosting habitat for birds
Ipomoea pes-caprae	Creeper	Anti-erosion, soil binding	
Spinifex littoreus	2–4 m	Excellent slope stabiliser White flowers → pollinators Fleshy fruits → birds	Hedges
Vitex trifolia (Simple-leafed Vitex)	1–3 m	Purple flowers loved by bees Fruits eaten by birds	Survives sandy/rocky soils and wind exposure
Pemphis acidula (Pemphis / Cangkok Laut)	1–2 m	Extremely wind- and salt-tolerant Forms beautiful sculptural shapes	Iconic littoral shrub of Penang's natural coast
Melastoma malabathricum	1–2 m	Purple flowers feed bees and butterflies Fruits eaten by birds	Widespread Malaysian native Thrives in disturbed soils — good for early succession
Guettarda speciosa	3–8 m	Shade, fruiting, supports moths & birds	One of the most characteristic native coastal shrubs in Penang Fragrant white flowers (night) • fruit eaten by birds Perfect for viewpoints and mid-slope



Photo: Existing vegetation at the Sore Thumb, forming a foundation that can be strengthened by carefully chosen supplementary planting to support local wildlife and site conditions.

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坡脚 / 防风带（耐盐雾及骨干植物）

表格栏目：物种 | 高度 | 功能 | 备注

Casuarina equisetifolia（木麻黄 / Rhu Laut）

高度：约6–12米。功能：防风、控制侵蚀。备注：距沙滩边缘退后2–3米种植，以避免根系裸露；为鸟类提供夜栖环境。

Ipomoea pes-caprae（马鞍藤）

高度栏：匍匐植物。功能：防侵蚀、固土。备注栏原文留空。

Spinifex littoreus（滨刺麦）

高度：2–4米。功能：优秀的稳坡植物；白花吸引传粉者；肉质果实供鸟类食用。备注：绿篱。

Vitex trifolia（三叶蔓荆 / Simple-leafed Vitex）

高度：1–3米。功能：紫花受蜜蜂喜爱；果实供鸟类食用。备注：可在沙质 / 岩石土壤及风力暴露环境中存活。

Pemphis acidula（水芫花 / Pemphis / Cangkok Laut）

高度：1–2米。功能：极耐风及盐分；形成优美的雕塑式形态。备注：槟城天然海岸具代表性的滨海灌木。

Melastoma malabathricum（野牡丹）

高度：1–2米。功能：紫花为蜜蜂及蝴蝶提供食物；果实供鸟类食用。备注：马来西亚广泛分布的本土植物；在受扰动土壤中生长良好，适合演替初期。

Guettarda speciosa（海岸桐）

Toe of Embankment / Windbreak Line (Salt-Spray Tolerant & Structural)

Species	Height	Function	Notes
Casuarina equisetifolia (Ribu Laut)	~8-12m	Windbreak, erosion control	Plant at 2–3 m offset from beach edge to avoid root exposure. Provides roosting habitat for birds
Impomoea pes-caprae	Creeper	Anti-erosion, soil binding	
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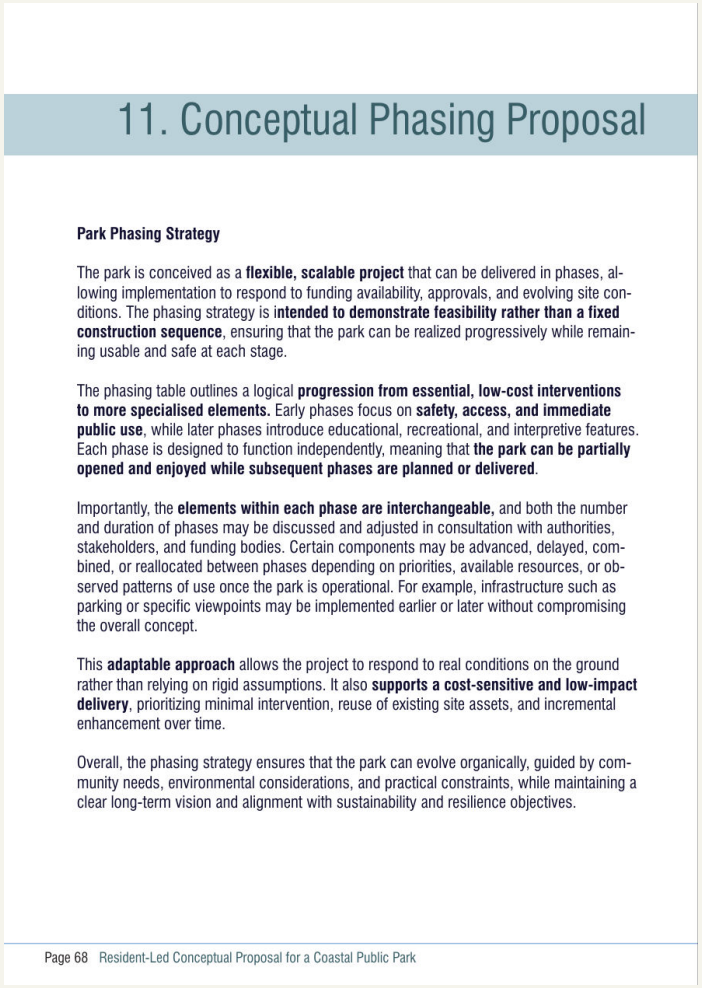
Photo: Existing vegetation at the Sore Thumb, forming a foundation that can be strengthened by carefully chosen supplementary planting to support local wildlife and site conditions.

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高度：3–8米。功能：遮荫、结果，支持蛾类及鸟类。备注：槟城最具特色的本土海岸灌木之一；夜间芳香的白花及供鸟类食用的果实；非常适合观景点及中坡。

照片：Sore Thumb的现有植被形成基础，可通过审慎选择的补充种植予以强化，以支持当地野生动物及场地条件。



11. Conceptual Phasing Proposal

Park Phasing Strategy

The park is conceived as a **flexible, scalable project** that can be delivered in phases, allowing implementation to respond to funding availability, approvals, and evolving site conditions. The phasing strategy is **intended to demonstrate feasibility rather than a fixed construction sequence**, ensuring that the park can be realized progressively while remaining usable and safe at each stage.

The phasing table outlines a logical **progression from essential, low-cost interventions to more specialised elements.** Early phases focus on **safety, access, and immediate public use**, while later phases introduce educational, recreational, and interpretive features. Each phase is designed to function independently, meaning that **the park can be partially opened and enjoyed while subsequent phases are planned or delivered**.

Importantly, the **elements within each phase are interchangeable,** and both the number and duration of phases may be discussed and adjusted in consultation with authorities, stakeholders, and funding bodies. Certain components may be advanced, delayed, combined, or reallocated between phases depending on priorities, available resources, or observed patterns of use once the park is operational. For example, infrastructure such as parking or specific viewpoints may be implemented earlier or later without compromising the overall concept.

This **adaptable approach** allows the project to respond to real conditions on the ground rather than relying on rigid assumptions. It also **supports a cost-sensitive and low-impact delivery**, prioritizing minimal intervention, reuse of existing site assets, and incremental enhancement over time.

Overall, the phasing strategy ensures that the park can evolve organically, guided by community needs, environmental considerations, and practical constraints, while maintaining a clear long-term vision and alignment with sustainability and resilience objectives.

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居民主导的公共海岸公园概念建议书

11. 概念分期实施建议

公园分期策略

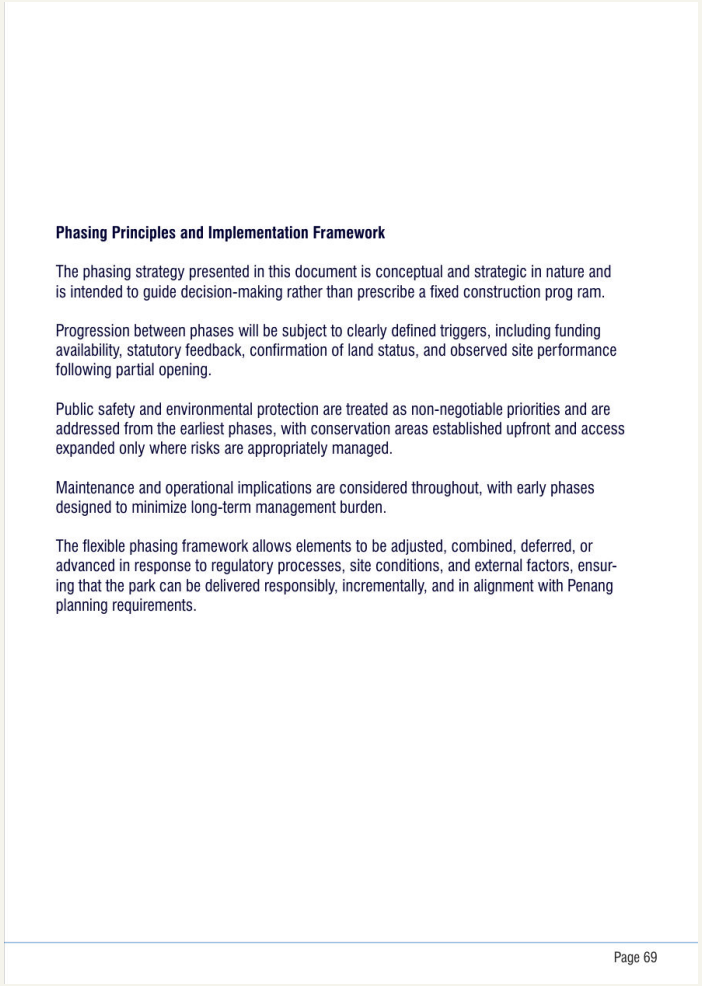
公园被构想为灵活、可扩展的项目，可分阶段实施，让建设回应资金供应、审批及不断变化的场地条件。分期策略旨在展示可行性，而非规定固定施工次序，确保公园逐步实现的同时，每一阶段都保持可使用及安全。

分期表提出由必要、低成本干预逐步发展至较专门元素的合理次序。早期阶段聚焦安全、通行及即时公众使用，后续阶段再加入教育、休闲及解说设施。每一阶段均可独立运作，意味着公园可先局部开放，让公众享用，同时规划或落实后续阶段。

重要的是，各阶段元素可互相调配，阶段数量及持续时间也可与主管部门、利益相关者及资助机构协商调整。视优先事项、可用资源，或公园投入使用后观察到的使用模式，个别组成部分可提前、推迟、合并，或重新分配至其他阶段。例如，停车设施或特定观景点，可在不影响整体概念的情况下提前或延后落实。

这种可调整方式让项目回应现场真实条件，而非依赖僵化假设。同时，它支持审慎控制成本及低影响实施，优先最小干预、重复利用场地现有资产，并随时间逐步改善。

总体而言，分期策略确保公园在社区需要、环境考虑及实际限制引导下有机发展，同时保持清晰的长期愿景，并与可持续及韧性目标一致。



Phasing Principles and Implementation Framework

The phasing strategy presented in this document is conceptual and strategic in nature and is intended to guide decision-making rather than prescribe a fixed construction prog ram.

Progression between phases will be subject to clearly defined triggers, including funding availability, statutory feedback, confirmation of land status, and observed site performance following partial opening.

Public safety and environmental protection are treated as non-negotiable priorities and are addressed from the earliest phases, with conservation areas established upfront and access expanded only where risks are appropriately managed.

Maintenance and operational implications are considered throughout, with early phases designed to minimize long-term management burden.

The flexible phasing framework allows elements to be adjusted, combined, deferred, or advanced in response to regulatory processes, site conditions, and external factors, ensuring that the park can be delivered responsibly, incrementally, and in alignment with Penang planning requirements.

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分期原则及实施框架

本文件提出的分期策略属于概念性、策略性框架，旨在指导决策，而非规定固定施工计划。

阶段之间的推进，将取决于明确条件，包括资金可用性、法定程序反馈、土地状态确认，以及局部开放后的场地实际表现。

公众安全及环境保护是不可妥协的优先事项，从最早阶段即予处理；保育区先行设立，只有在风险得到适当管理之处才扩大通行范围。

整个过程均考虑维护及营运影响，早期阶段旨在尽量降低长期管理负担。

灵活的分期框架容许根据监管程序、场地条件及外部因素，调整、合并、延后或提前各项元素，确保公园以负责任、渐进的方式落实，并符合槟城规划要求。

Indicative Phasing Plan for Park Implementation

Phase	Focus	Key Elements
Phase 1 **Minimum Viable Park**	Safety, access & views	• Learning Steps; • Primary circulation / viewpoint path; terrain safety measures (surface stabilization, localized protection); • Modest visitor parking; • Basic park furniture; • Initial wayfinding; • Protective fencing defining wildlife conservation areas with "no-entry" signage
Phase 2 **Foreshore Access**	Coastal connection	• Foreshore steps; • Improved access to fishing spot with basic safety and seating
Phase 3 **Learning & Play**	Education & community use	• Learning Steps enriched with educational and interpretive elements; • Kingfisher Deck viewing platform with roof (form and size to be determined); • Nature-based play and learning features; biodiversity interpretation
Phase 4 **Eagle's View-point**	Wildlife observation & interpretation	• Eagle's Viewpoint – a small, secluded structure designed for bird and wildlife observation; • Advanced interpretation; digital / QR-based content

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居民主导的公共海岸公园概念建议书

阶段 | 重点 | 主要元素

第1阶段：具基本功能的公园

重点：安全、通行及景观。

主要元素：

• 探知阶梯；

• 主要通行 / 观景路径；地形安全措施（地表稳固、局部保护）；

• 小规模访客停车区；

• 基本公园设施；

• 初步导向标识；

• 以保护围栏界定野生动物保育区，并设置"禁止进入"标牌。

第2阶段：滨岸通行

重点：海岸联系。

主要元素：

• 滨岸阶梯；

• 改善通往垂钓点的通道，提供基本安全设施及座椅。

第3阶段：学习与游戏

重点：教育及社区使用。

主要元素：

Indicative Phasing Plan for Park Implementation

Phase	Focus	Key Elements
Phase 1 **Minimum Viable Park**	Safety, access & views	• Learning Steps; • Primary circulation / viewpoint path; terrain safety measures (surface stabilization, localized protection); • Modest visitor parking; • Basic park furniture; • Initial wayfinding; • Protective fencing defining wildlife conservation areas with "no-entry" signage
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简体中文译文 · 续

• 为探知阶梯增加教育及解说元素；

• 设屋顶的翠鸟观景平台（形态及尺寸待定）；

• 自然游玩及学习设施；生物多样性解说。

第4阶段：观鹰点

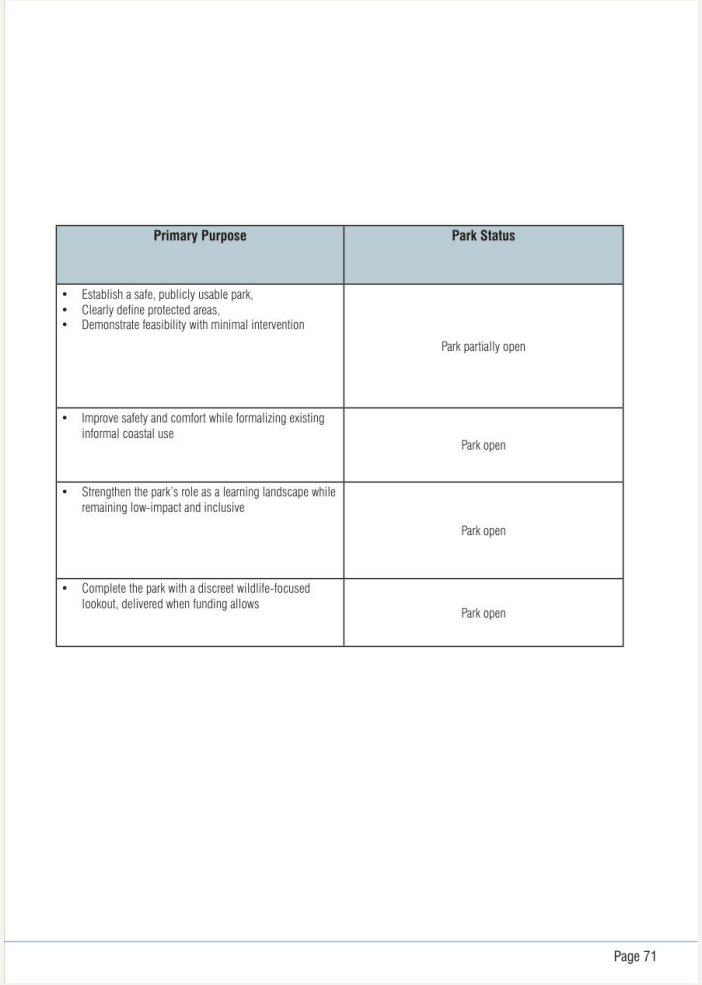
重点：野生动物观察及解说。

主要元素：

• 观鹰点——供观察鸟类及野生动物的小型、幽静结构；

• 进阶解说；数字 / 二维码内容。

公园实施的示意分期计划



Primary Purpose	Park Status
• Establish a safe, publicly usable park, • Clearly define protected areas, • Demonstrate feasibility with minimal intervention	Park partially open
• Improve safety and comfort while formalizing existing informal coastal use	Park open
• Strengthen the park's role as a learning landscape while remaining low-impact and inclusive	Park open
• Complete the park with a discreet wildlife-focused lookout, delivered when funding allows	Park open

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主要目的 | 公园状态

第1阶段

• 建立安全、可供公众使用的公园；

• 清晰划定受保护区域；

• 以最小干预展示可行性。

公园状态：局部开放。

第2阶段

• 改善安全与舒适度，同时使现有非正式海岸使用得到规范。

公园状态：开放。

第3阶段

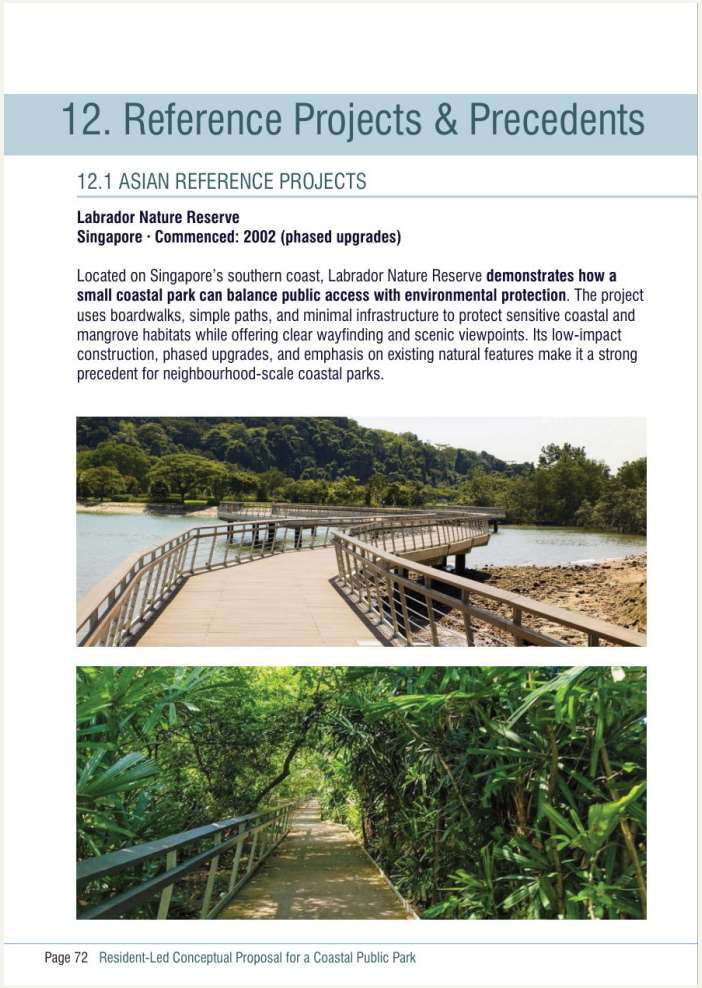
• 强化公园作为学习景观的角色，同时维持低影响及包容性。

公园状态：开放。

第4阶段

• 在资金允许时，建成低调、以野生动物为重点的观景点，完善公园。

公园状态：开放。



12. Reference Projects & Precedents

12.1 ASIAN REFERENCE PROJECTS

Labrador Nature Reserve
Singapore · Commenced: 2002 (phased upgrades)

Located on Singapore's southern coast, Labrador Nature Reserve **demonstrates how a small coastal park can balance public access with environmental protection**. The project uses boardwalks, simple paths, and minimal infrastructure to protect sensitive coastal and mangrove habitats while offering clear wayfinding and scenic viewpoints. Its low-impact construction, phased upgrades, and emphasis on existing natural features make it a strong precedent for neighbourhood-scale coastal parks.

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居民主导的公共海岸公园概念建议书

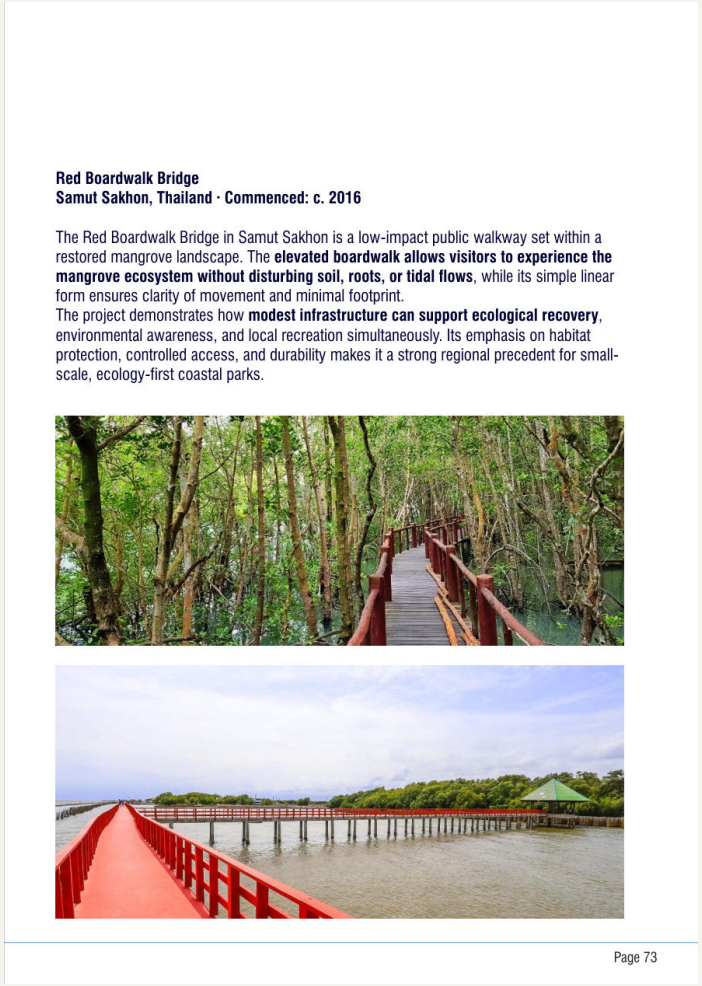
12. 参考项目与先例

拉柏多自然保护区（Labrador Nature Reserve）

新加坡。开始于2002年（分阶段改善）。

拉柏多自然保护区位于新加坡南部海岸，展示小型海岸公园如何兼顾公众通行与环境保护。项目使用栈道、简单步道及最少量基础设施，保护敏感海岸及红树林栖息地，同时提供清晰导向及风景观景点。其低影响施工、分期改善及对现有自然特征的重视，使其成为邻里尺度海岸公园的重要参考。

12.1 亚洲参考项目



Red Boardwalk Bridge
Samut Sakhon, Thailand · Commenced: c. 2016

The Red Boardwalk Bridge in Samut Sakhon is a low-impact public walkway set within a restored mangrove landscape. The **elevated boardwalk allows visitors to experience the mangrove ecosystem without disturbing soil, roots, or tidal flows**, while its simple linear form ensures clarity of movement and minimal footprint.
The project demonstrates how **modest infrastructure can support ecological recovery**, environmental awareness, and local recreation simultaneously. Its emphasis on habitat protection, controlled access, and durability makes it a strong regional precedent for small-scale, ecology-first coastal parks.

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红色栈道桥（Red Boardwalk Bridge）

泰国龙仔厝（Samut Sakhon）。约2016年开始。

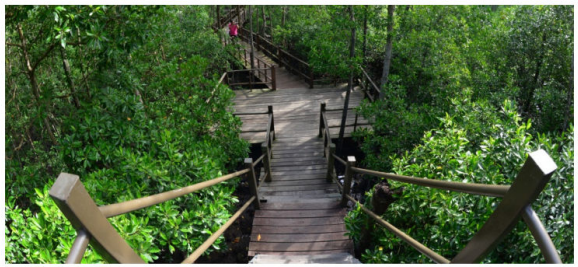
龙仔厝红色栈道桥是一条位于恢复后的红树林景观中的低影响公共步道。架高栈道让访客体验红树林生态系统，而不扰动土壤、根系或潮汐流动；其简单的线性形态确保路线清晰，占地最小。

项目展示适度基础设施如何同时支持生态恢复、环保意识及地方休闲。它强调栖息地保护、受控通行及耐久性，是小规模、生态优先的海岸公园的重要区域参考。

Mangrove Education Walk, Tanjung Piai
Johor, Malaysia · Commenced: 2001

Tanjung Piai National Park includes a network of timber boardwalks through dense mangrove forests at the southernmost tip of mainland Asia. The project focuses on **environmental protection, coastal resilience, and public education,** using minimal built elements to allow visitors to experience the mangrove ecosystem safely. It is a strong Malaysian precedent for low-impact coastal access and habitat interpretation.





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居民主导的公共海岸公园概念建议书

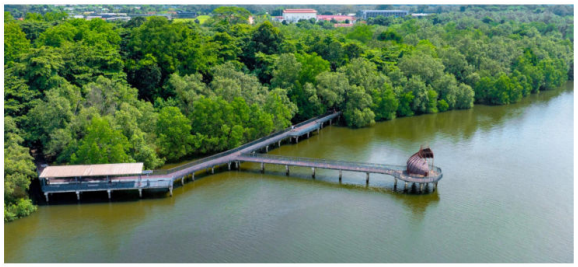
丹绒比艾红树林教育步道（Mangrove Education Walk, Tanjung Piai）

马来西亚柔佛。开始于2001年。

丹绒比艾国家公园位于亚洲大陆最南端，设有穿越茂密红树林的木栈道网络。项目聚焦环境保护、海岸韧性及公众教育，以最少量建筑元素，让访客安全体验红树林生态系统。它是马来西亚低影响海岸通行及栖息地解说的重要参考。

Pasir Ris Park
Singapore · Commenced: 1986 (phased development)

Pasir Ris Park is a neighbourhood-scale coastal park that successfully integrates a public sandy beach with protected mangrove habitats. Elevated boardwalks provide controlled access through sensitive ecological zones, while open beach areas allow for informal recreation without compromising habitat integrity. The park is delivered in clearly zoned and phased layers, separating active public use from conservation areas. Its combination of beach access, mangrove protection, low-impact infrastructure, and long-term manageability makes it a particularly strong precedent for small coastal parks that balance ecology, public access, and cost-efficient maintenance.





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白沙公园（Pasir Ris Park）

新加坡。开始于1986年（分阶段发展）。

白沙公园是邻里尺度的海岸公园，成功将公共沙滩与受保护的红树林栖息地结合。架高栈道提供通过敏感生态区的受控通道，开放沙滩则容许非正式休闲活动，同时不损害栖息地完整性。公园以清晰分区及分期层次实施，将活跃的公众使用与保育区分开。它结合沙滩通行、红树林保护、低影响基础设施及长期可管理性，是兼顾生态、公众通行与具成本效益维护的小型海岸公园的特别有力先例。

Mount Maunganui (Mauao) Reserve
Tauranga, New Zealand

Mount Maunganui (Mauao) Reserve is a coastal park that uniquely combines a prominent **natural hill with sandy beaches** on both sides, forming a continuous public landscape of high ecological and recreational value. The volcanic hill is protected as a cultural and ecological reserve, with carefully **managed walking tracks that follow natural contours and minimize erosion.** At its base, open **beaches provide public access** and informal recreation, clearly separated from sensitive slopes and vegetation zones.
The park demonstrates how **topography, views, and natural systems can define the park's identity with minimal built intervention.** Its emphasis on controlled access, erosion management, and respect for natural landform makes it a strong precedent for coastal parks where views and terrain are the primary assets.





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居民主导的公共海岸公园概念建议书

芒格努伊山（Mauao）保护区〔Mount Maunganui (Mauao) Reserve〕

新西兰陶朗加（Tauranga）

芒格努伊山（Mauao）保护区是一座海岸公园，将显著的天然山丘与两侧沙滩独特地结合，形成具有高度生态及休闲价值的连续公共景观。火山丘作为文化及生态保护区受到保护，步行路径经过审慎管理，沿天然等高线布置，以尽量减少侵蚀。山脚的开放沙滩提供公众通行及非正式休闲，与敏感坡面及植被区清晰分开。

公园展示地形、景观及自然系统如何以最少的建筑干预定义公园身份。它强调受控通行、侵蚀管理及尊重自然地形，是以景观和地形为主要资产的海岸公园的重要参考。

Bishan–Ang Mo Kio Park
Singapore · Commenced: 2007 (redevelopment completed 2012)

Bishan–Ang Mo Kio Park, developed with Singapore's National Parks Board and Public Utilities Board, is a seminal example of **bringing landscape and ecology to the center of an urban park's identity**. As part of the Active, Beautiful, Clean Waters Program, a formerly straight, concrete drainage channel of the Kallang River was transformed into a naturalized, meandering river system. Stormwater management, soil bio-engineering, and native planting are integrated to create a dynamic ecological landscape that is both functional and accessible to the public. The project successfully combines hydrological performance with everyday recreation, allowing direct interaction with water while enhancing biodiversity and urban resilience. Reuse of existing materials and ecologically driven bank stabilization demonstrate how natural processes can guide sustainable and resilient public space design.





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碧山—宏茂桥公园（Bishan–Ang Mo Kio Park）

新加坡。开始于2007年（改建于2012年完成）。

碧山—宏茂桥公园与新加坡国家公园局及公用事业局合作发展，是将景观与生态置于城市公园身份核心的重要典范。作为“活跃、美丽、清洁水源计划”（Active, Beautiful, Clean Waters Program）的一部分，原本笔直、以混凝土铺设的加冷河排水渠，被改造成自然化、蜿蜒的河流系统。项目结合雨洪管理、土壤生物工程及本土种植，创造既具功能、又向公众开放的动态生态景观。它成功将水文表现与日常休闲结合，让人们可直接亲水，同时提升生物多样性及城市韧性。重复利用现有材料及由生态原则引导的河岸稳定措施，展示自然过程如何指导可持续、具韧性的公共空间设计。