

Coastal Management Strategies

Study of Coastal Hazards under Climate Change and Extreme Weather and Formulation of Improvement Measures – Feasibility Study

13 October 2022



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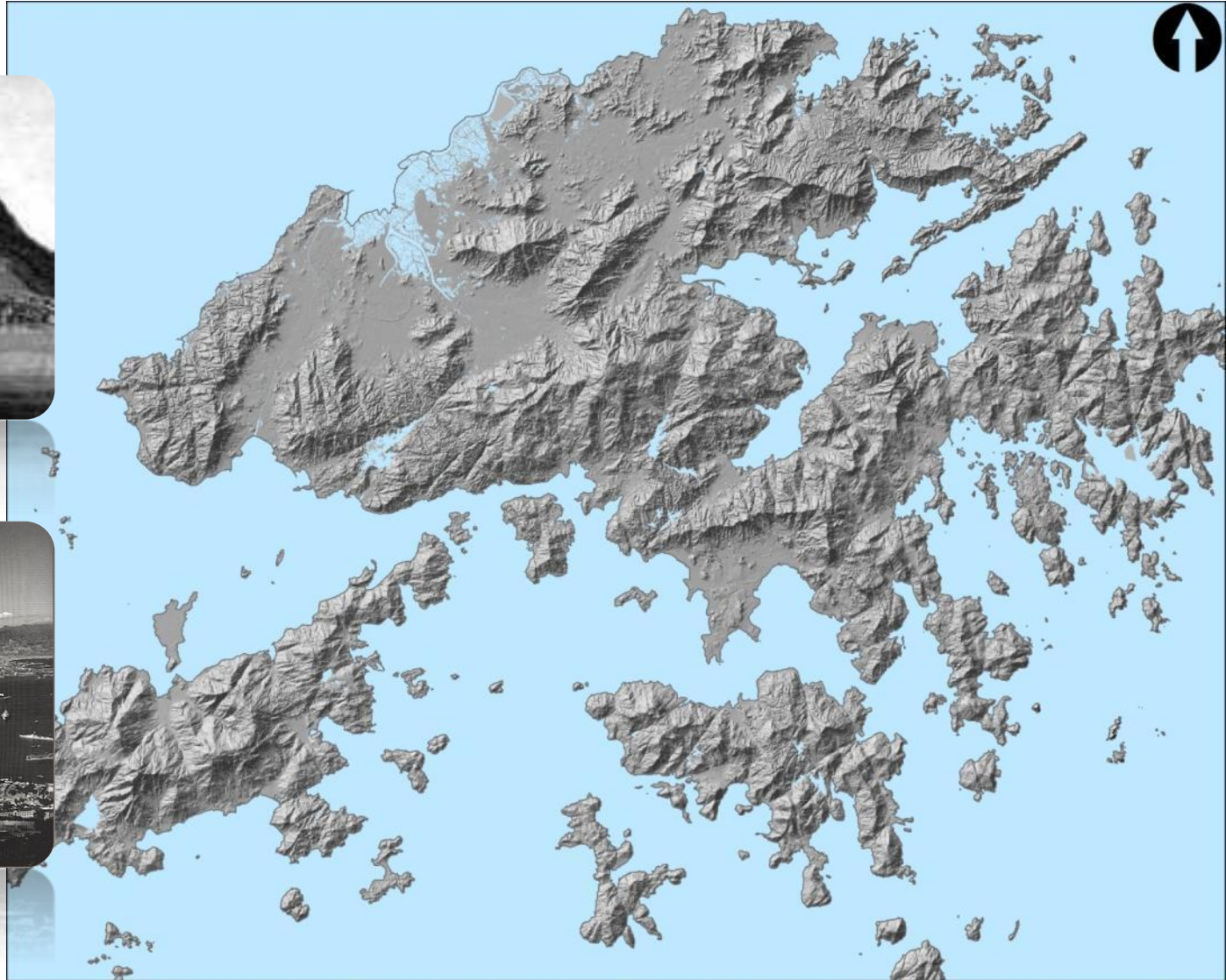
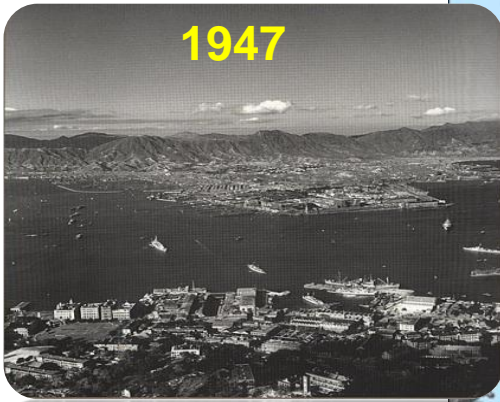
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Development of Hong Kong Coastline and Role of Port Works Division



Hong Kong Coastline – Early Age



Hong Kong Coastline – 2010s

Total Land Area
(about 1,110 km²)

Reclaimed Land
(about 70 km²)

Total Coastline
(about 1,100 km)

Artificial Coastline
(about 200 km)

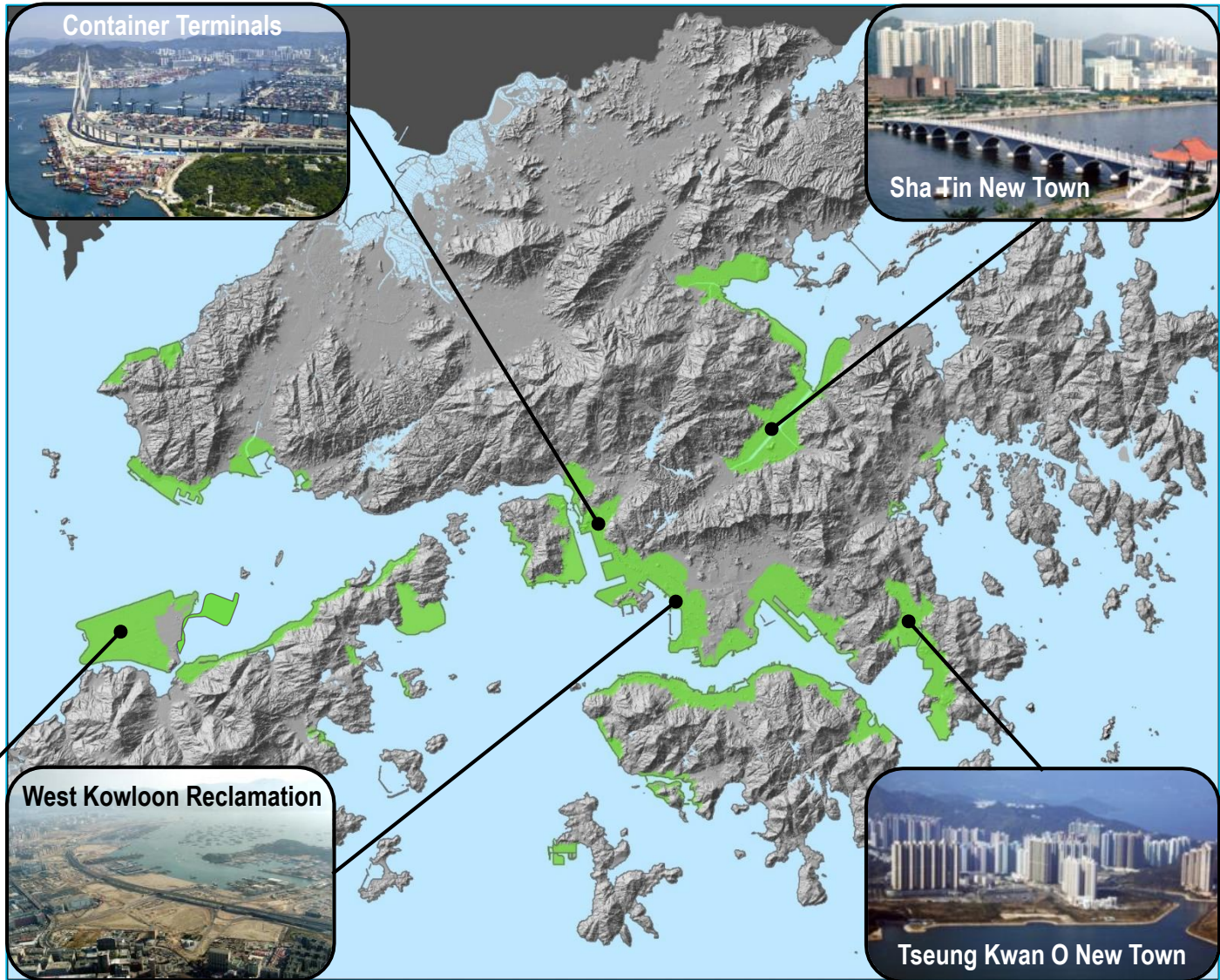
Hong Kong International
Airport

Container Terminals

Sha Tin New Town

West Kowloon Reclamation

Tseung Kwan O New Town





▲
Typhoon Shelters



▲
Beacons



▲
Piers



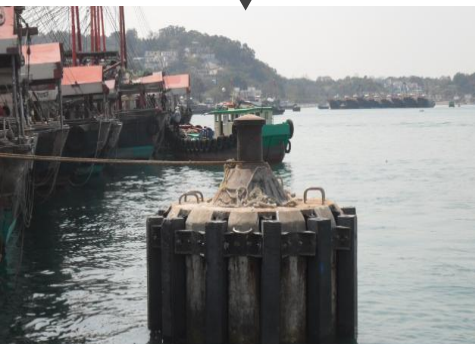
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Breakwaters

Port Works Division

▼
Landing Steps



▼
Dolphins



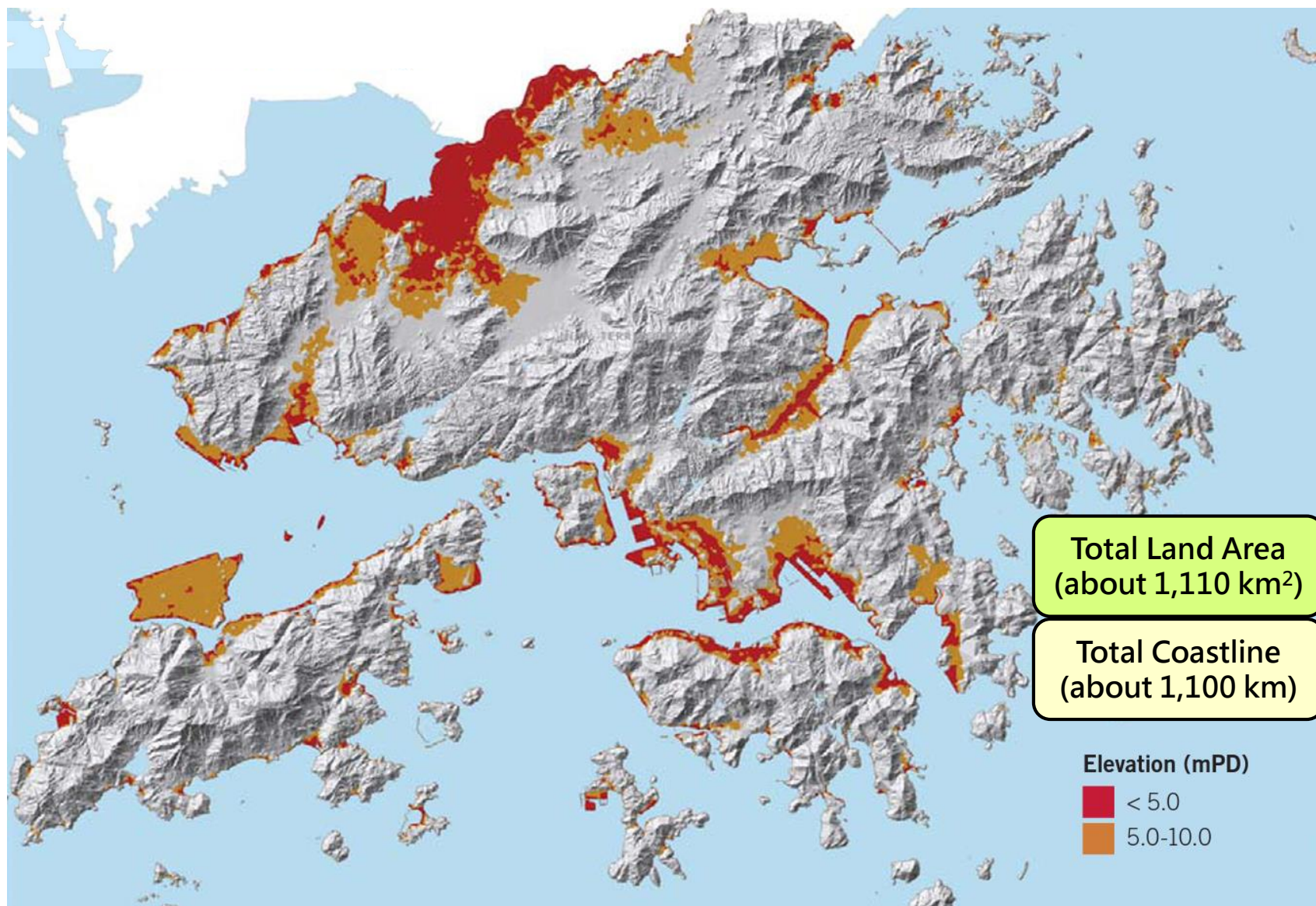
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Anchorage Areas



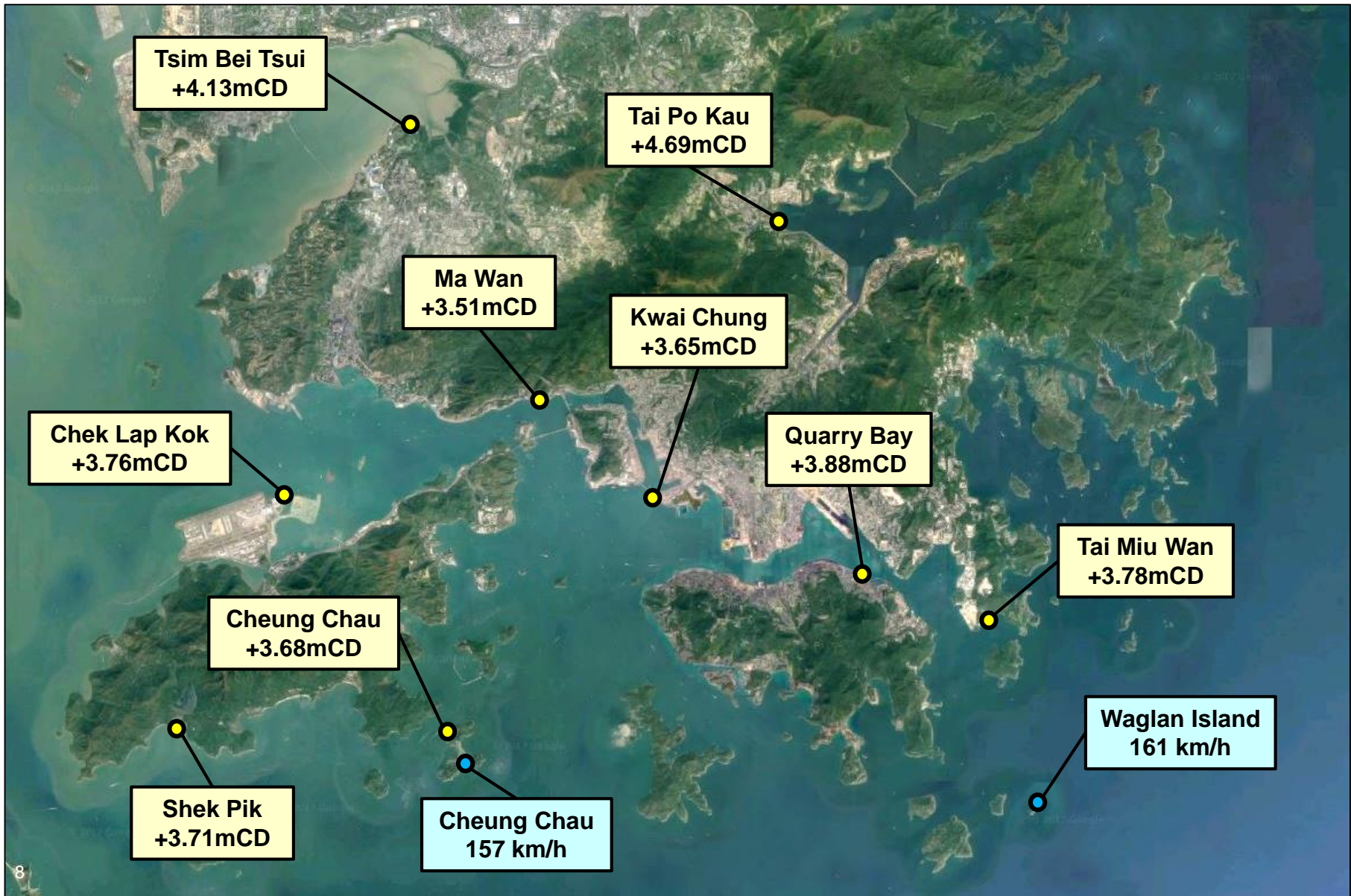
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Seawalls



Topography of Hong Kong

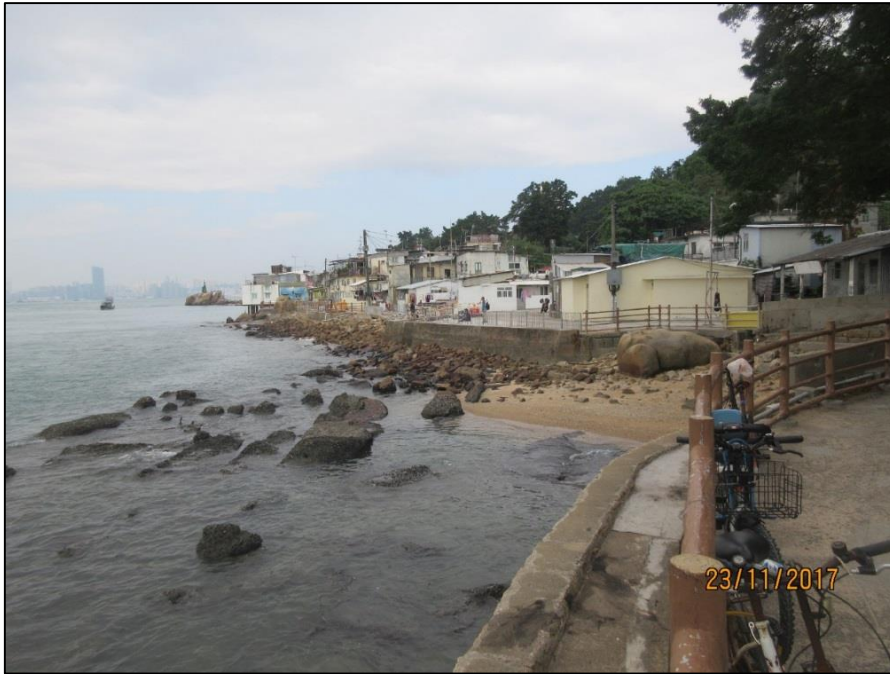


Maximum Sea Levels and Hourly Wind Speeds during Super Typhoon Mangkhut (16 Sep 2018)



Enhancement of Coastal Structures and Facilities

Enhancement Works at Lei Yue Mun



Before Works



After Works

Enhancement of Coastal Structures and Facilities

Enhancement Works at Tseung Kwan O South Waterfront Park



Before Works



After Works

Enhancement of Coastal Structures and Facilities

Enhancement Works at Aberdeen Typhoon Shelter



Before Works



After Works

Enhancement of Coastal Structures and Facilities

Enhancement Works at Sai Kung Sewage Treatment Works



Before Works



After Works

Study of Coastal Hazards under Climate Change and Extreme Weather and Formulation of Improvement Measures – Feasibility Study (Coastal Hazards Study)

- Assessing the impacts of **extreme weather and climate change** on **coastal low-lying and windy areas**
- **Risk management approach**
 - **Likelihood** of coastal hazards and severity of **consequence**
 - **Identify** coastal low-lying and windy areas more vulnerable to higher potential risks
- **Enhancement measures**



Strategy for Adapting to Coastal Risks



Medium-to-long-term decarbonisation targets



Total carbon emissions
Compared with 2005 level



Four decarbonisation strategies



Net-zero Electricity Generation



Energy Saving and Green Buildings

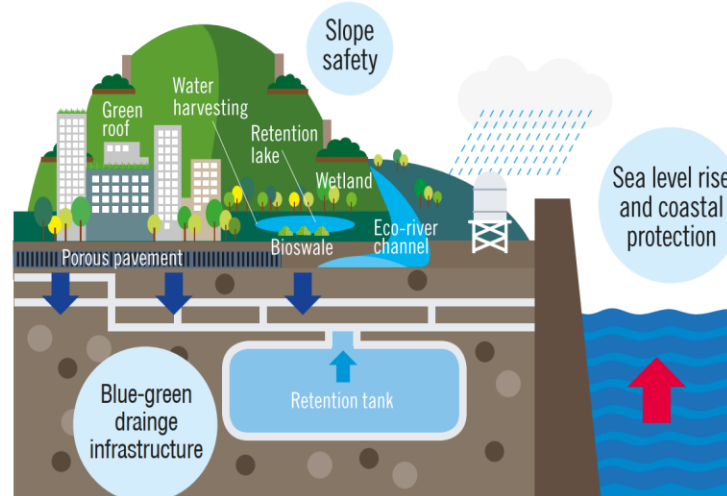


Green Transport



Waste Reduction

Adaptation



Resilience



Prepare for emergencies



Deal with extreme heat



Raise community awareness

Climate Hazards - Extreme weather events

Heavy Rain + Storm Surge + Wind Wave + Sea-level Rise



熱帶氣旋引起的風暴潮及大浪
Storm surge and high waves caused
by tropical cyclones



降雨增加
Enhanced rainfall rate

颱風的強度增加會帶來更極端風暴潮
及風浪
More extreme storm surge & wind
waves due to more intense typhoons

平均海平面 Mean sea level

海圖基準面 Chart Datum

平均海平面 Mean sea level

海平面上升 Sea level rise

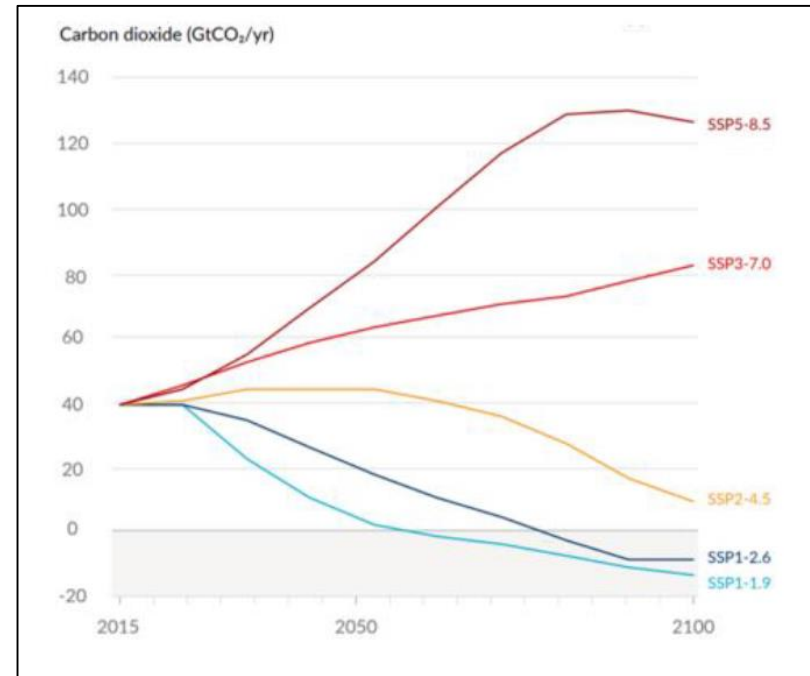
海圖基準面 Chart Datum



Climate Change Projection

- Intergovernmental Panel on Climate Change (**IPCC**)
- IPCC's Fifth and Sixth **Assessment reports** (AR5, 2013 & AR6, 2021)
- **Paris Agreement (2015)** - to keep the increase in global average temperature to well below 2°C above pre-industrial levels
- **COP26 meeting (2021)** pledged to achieve the Paris Agreement target

	2081-2100 <i>Very likely range (°C)</i>
SSP1-1.9	1.0-1.8
SSP1-2.6	1.3-2.4
SSP2-4.5	2.1-3.5
SSP3-7.0	2.8-4.6
SSP5-8.5	3.3-5.7

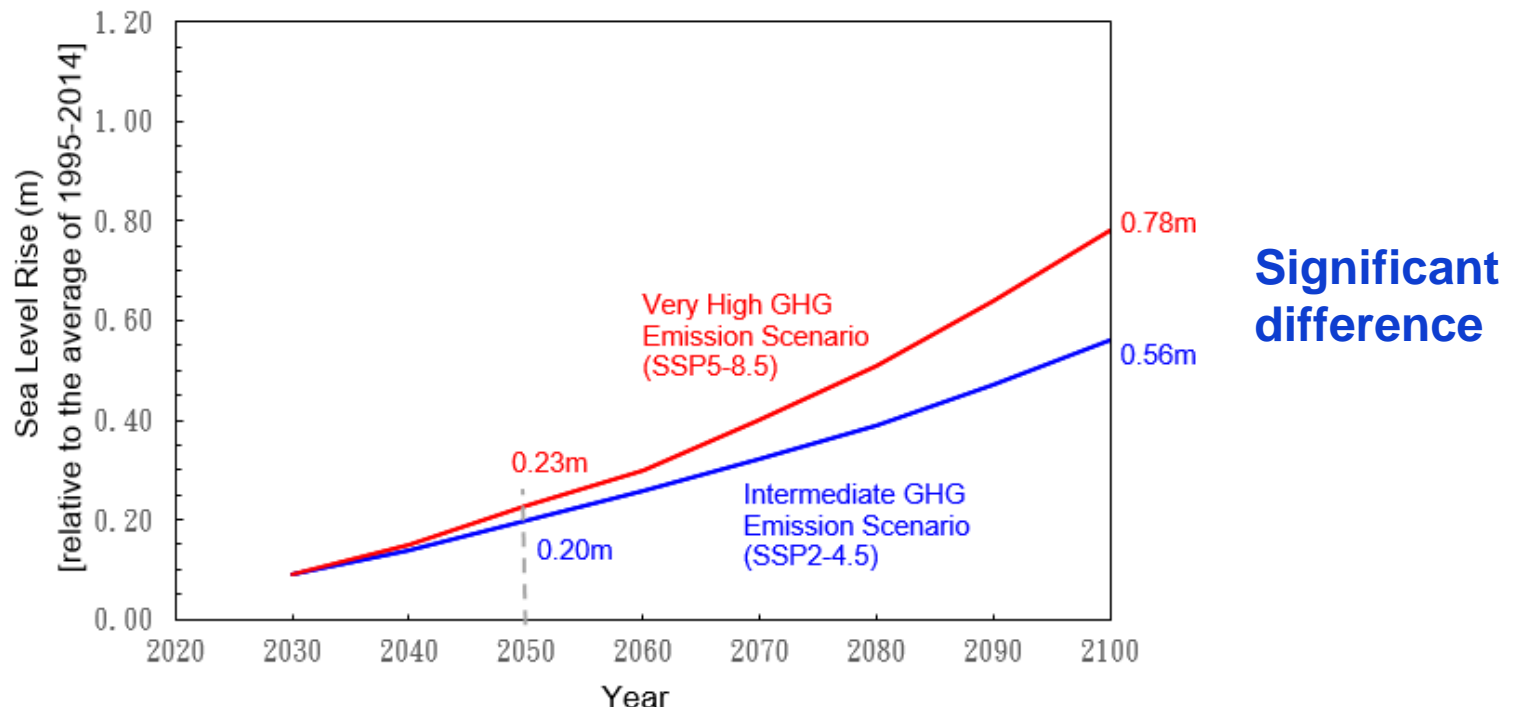


Projection of CO₂ Emissions in Different Scenarios (IPCC AR6)

Strategy For Adapting To Coastal Risks

Evaluation Method

- Extreme weather (100-year return period) + Climate change effect (Sea level rise up to 2050 under intermediate greenhouse gas emission scenario)



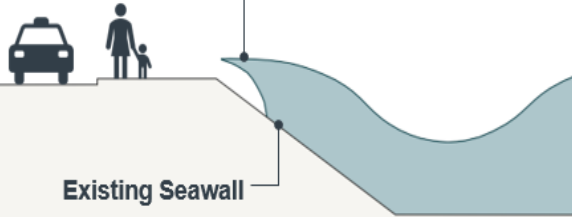
Reference: *The Sixth Assessment Report of the Intergovernmental Panel on Climate Change*



Progressive Adaptive Approach

Risk of Coastal Hazard under Climate Change (with climate change projections up to mid-century)

Risk treatment is required to reduce the anticipated risk



Short to Medium Term Measures (for up to mid-century)

Adequate structural reserve for future upgrade

Anticipated risk

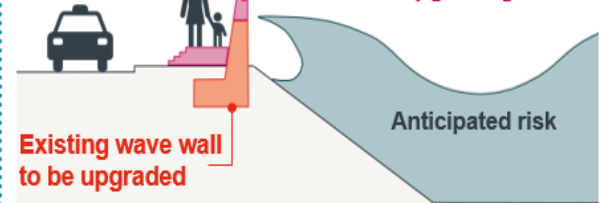
Wave wall to reduce risk



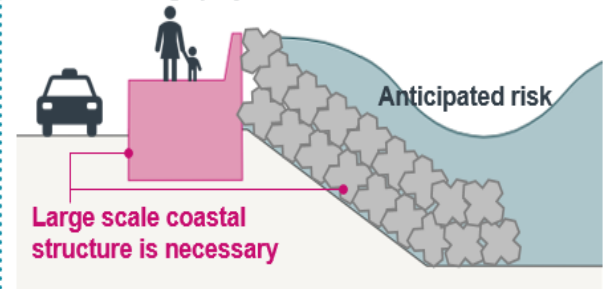
Long Term Measures (for beyond mid-century)

If climate change projection follows assumed scenario

Wave wall upgrading



If climate change projection exceeds assumed scenario



* Remark: Drainage enhancement, such as pumping station, might be needed at the back of the wall



Demonstration of Coastal Marine Structures to deal with Wave Attack



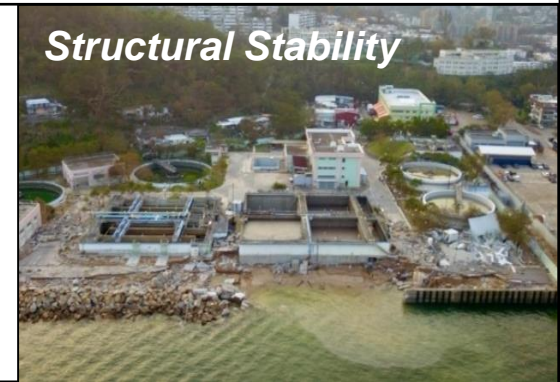
Identification of Coastal Areas to be Enhanced



Risk-Management Approach

Risk Assessment - Likelihood x Consequence

Likelihood of Coastal Hazards



Severity of Consequence



26 Coastal Residential Areas for Enhancement



Multi-layered Enhancement Measures



Enhancement Measures

- Make reference to overseas and local experience



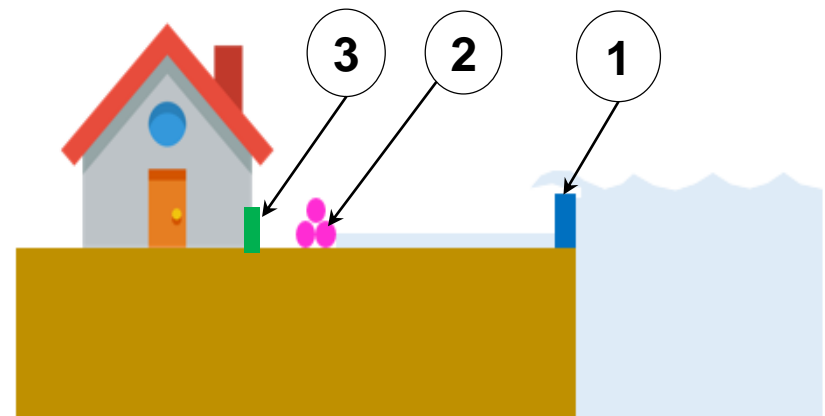
Multi-layered Enhancement Measures

Improvement Works

- ① Constructing or raising wave walls along coastline
- ② Installing fixed and/or demountable flood barriers at suitable places behind coastline
- ③ Installing demountable flood barriers at building frontages

Management Measures

- ④ Action plans with early alert system for areas with ② / ③



Measure ① - Constructing / Raising Wave Wall

1. Constructing or raising wave wall along coastline

- To reduce coastal hazards



Measures ② and ③ - Flood Barriers

2. Fixed and/or demountable flood barriers behind coastline

- To cut off water pathway



3. Demountable flood barriers at building frontages

- Self-protection



Examples of Demountable Flood Barriers in Hong Kong



Heng Fa Chuen Playground



Tai Ping Street, Tai O



South Horizons Resident Club



Yat Chung Riverwall, Tai O



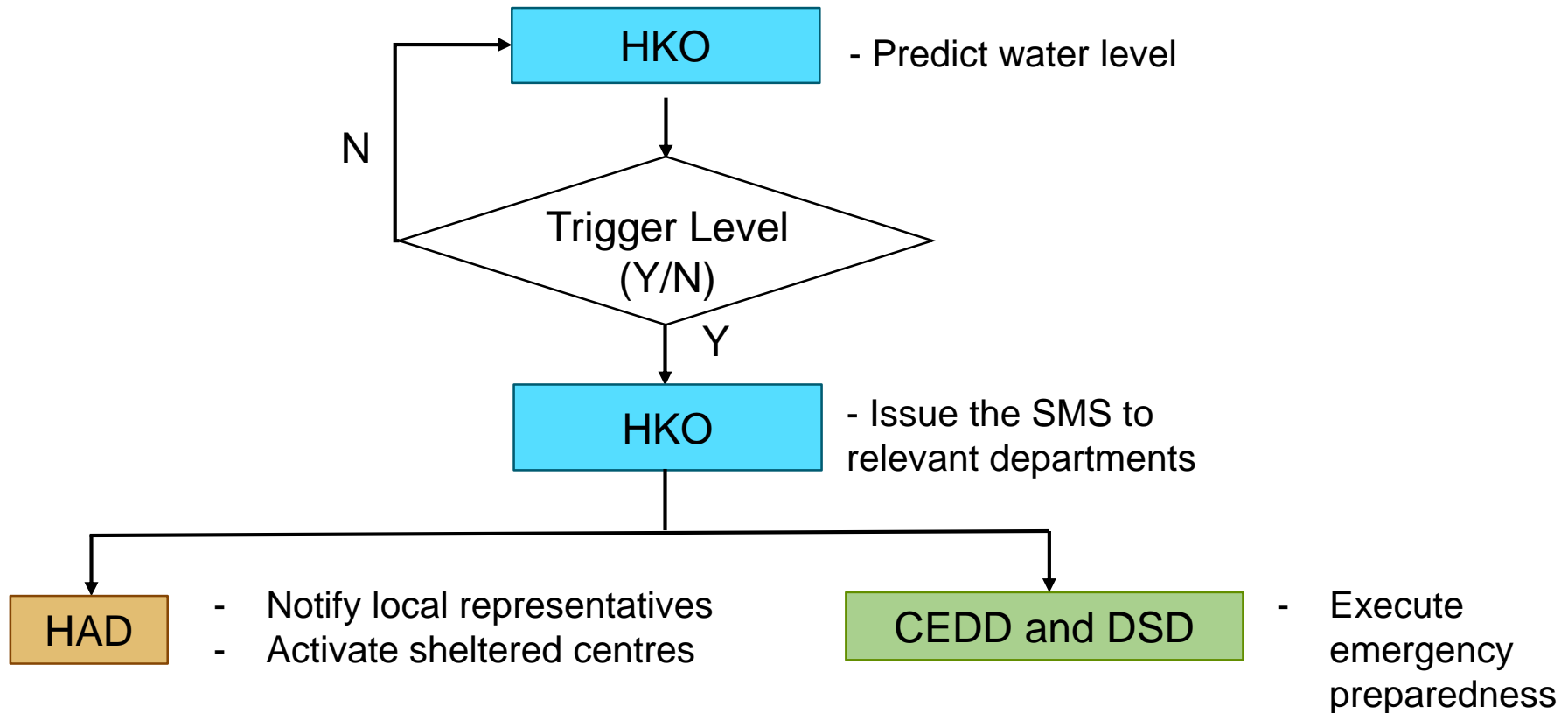
Management Measures

Action plans on early alert system and emergency preparedness

- ❖ Triggering level of early alert system
- ❖ Sandbags and demountable flood gates
- ❖ Opening of temporary shelters and pumping facilities
- ❖ Emergency preparedness gangs



Action Plan – Early Alert System



Implemented Action Plans

- 26 coastal residential areas
- Formulated management measures and action plan
- Informed relevant residents' representatives
- Drilled and implemented in May 2022



Examples of Schematic Design of Enhancement Measures



Lei Yue Mun

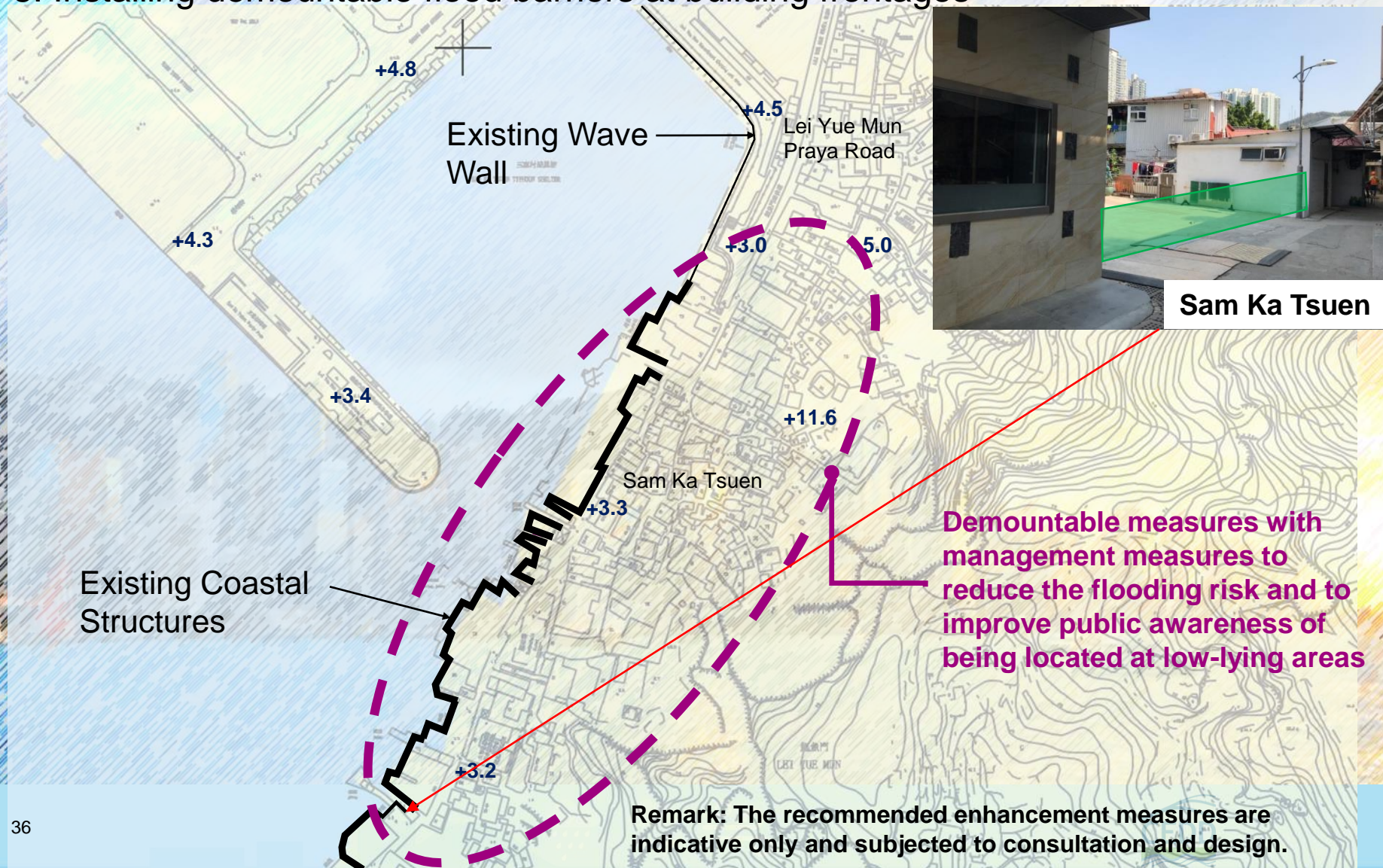


Reason of Coastal Flooding – Storm Surge Increase and Overtopping Wave



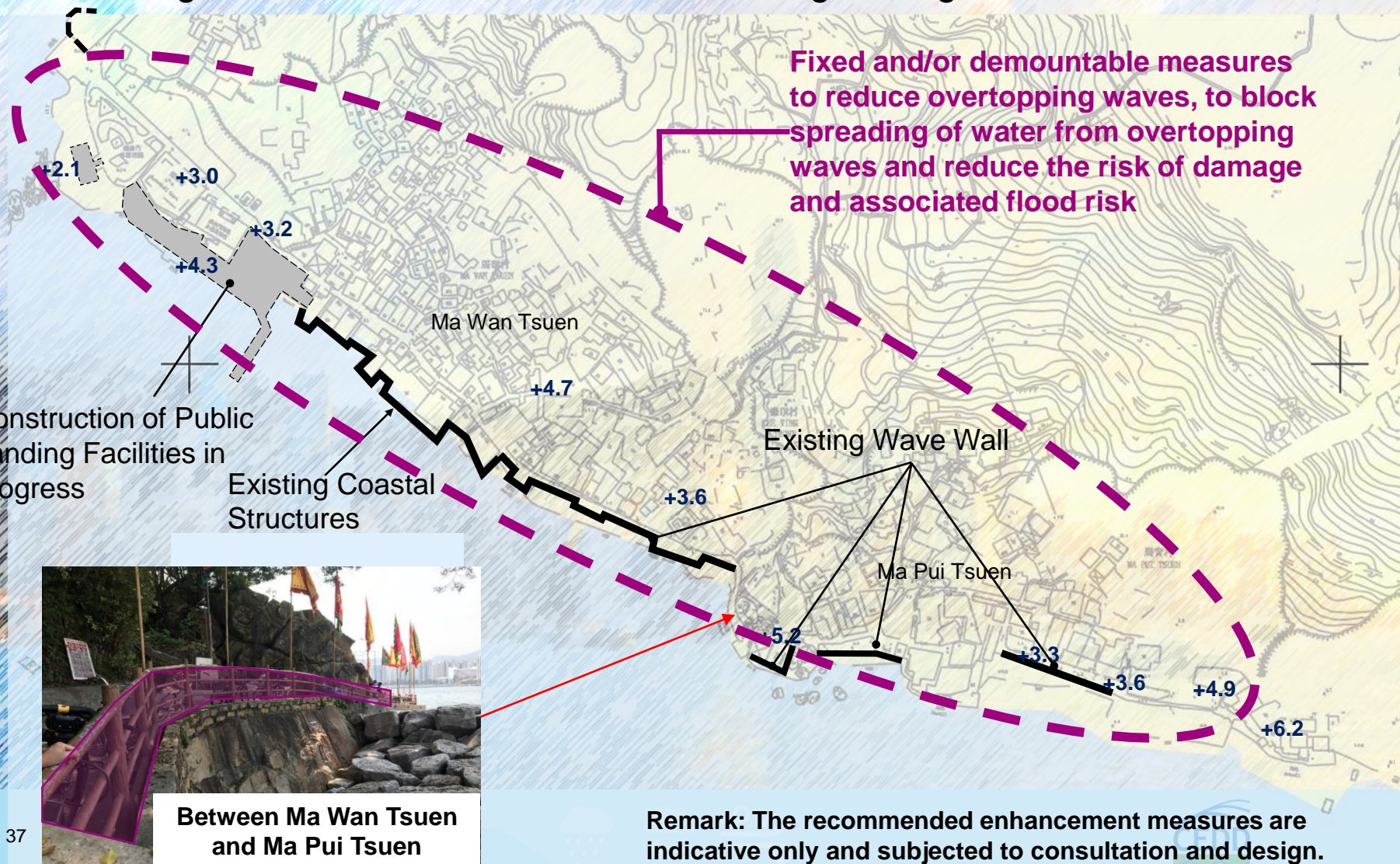
Recommended Enhancement Measures (Sam Ka Tsuen)

2. Installing demountable flood barriers at suitable places behind the coastline to cut off water pathway towards inlands; and/or
3. Installing demountable flood barriers at building frontages



Recommended Enhancement Measures (Ma Wan Tsuen)

1. Constructing wave wall along the coastline; and/or
2. Installing demountable flood barriers at suitable places behind the coastline to cut off water pathway towards inlands; and/or
3. Installing demountable flood barriers at building frontages





Tseung Kwan O South (Tsueng Kwan O Waterfront Park)



Completed improvement measures

TKO Waterfront Park – Concrete Wave Wall

After the passage of Super Typhoon

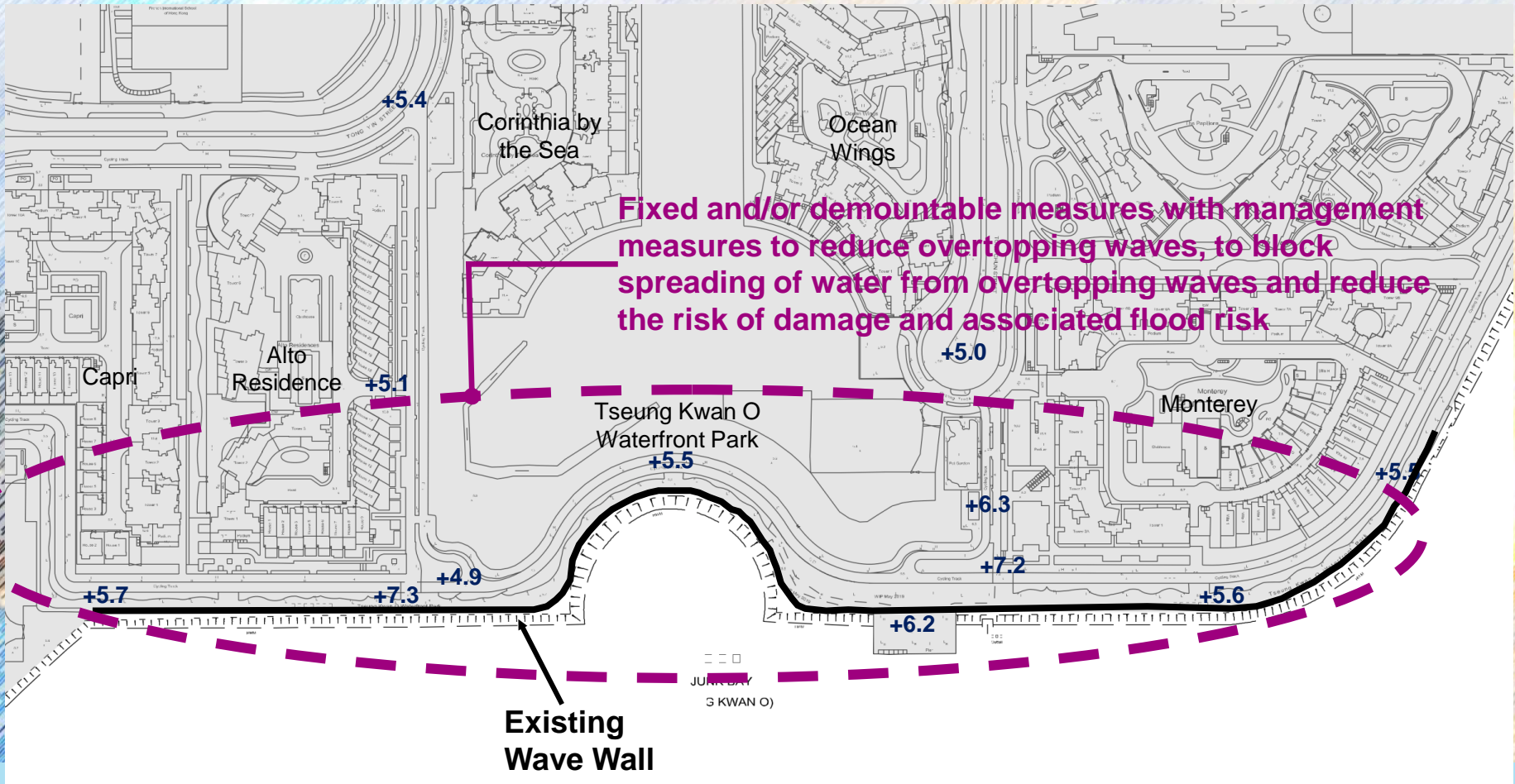


New concrete wave



Recommended Enhancement Measures (TKO South)

1. Wave wall along the coastline (Constructed); and/or
2. Installing fixed and/or demountable flood barriers at suitable places behind the coastline to cut off water pathway towards inlands



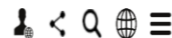
Way Forward



Innovation in Coastal Enhancement



Real-time water level monitoring



Home > 天氣 > 天氣預測 > 特別天氣提示

特別天氣提示

現時並無特別天氣提示。

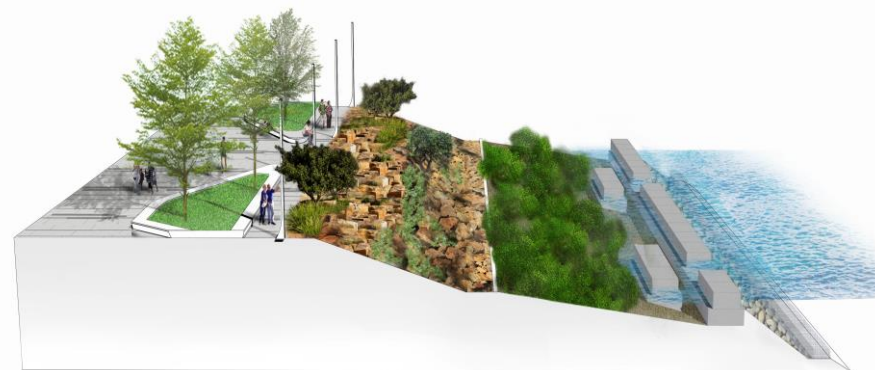
Special weather tips



Electronic panel



Real-time wave monitoring



Nature-based solution

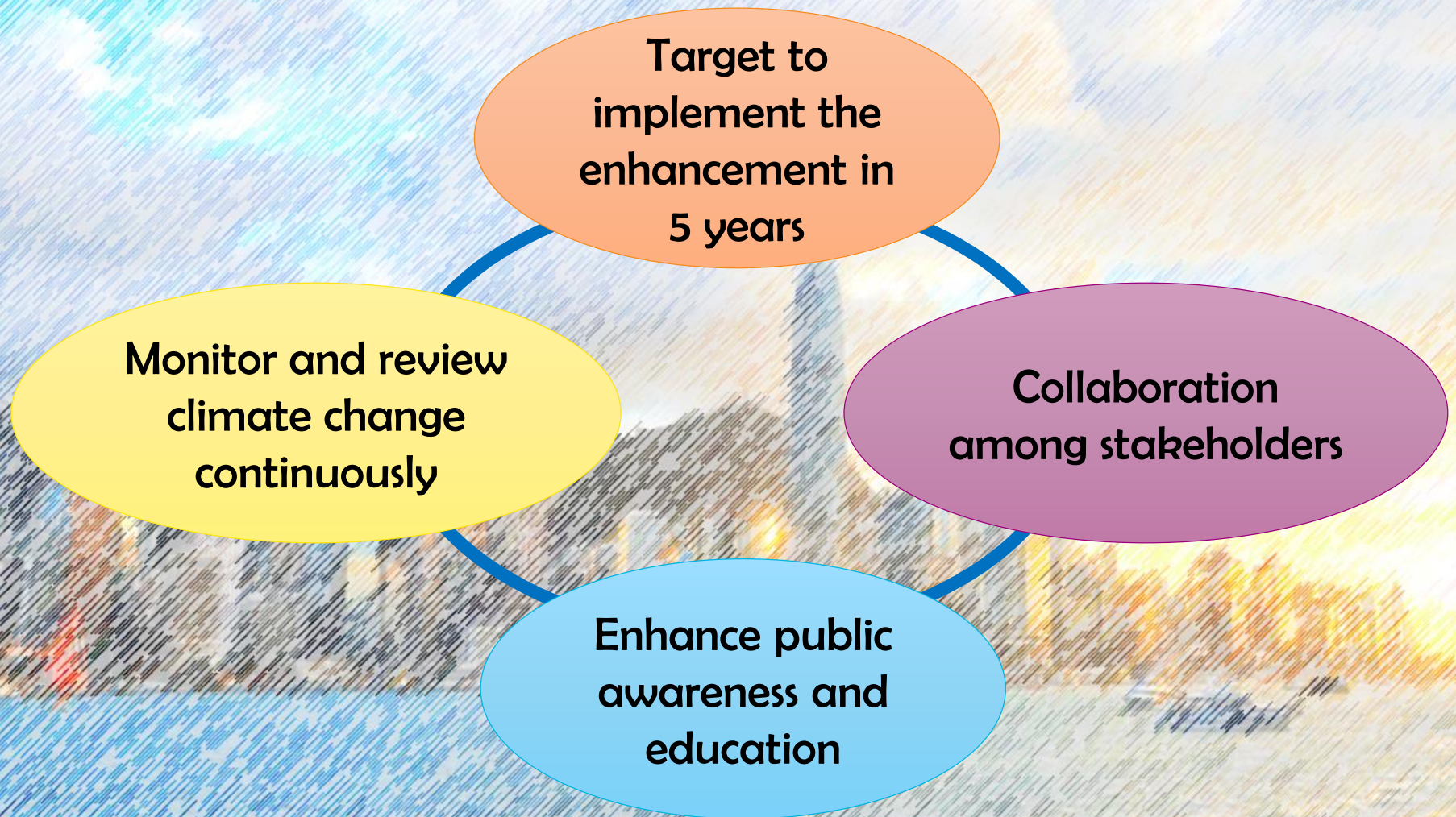


Long-term planning

Study on Shoreline Management Plan



Way forward



Way forward

We should bear in mind !



Thank you

<https://www.city.discovery.com/hong-kong/tour.php?id=656>

