

Blue-Green / Sponge City Concept : Adapting to Climate Change

PURPOSE

This paper aims to brief Members on the concept of “Blue-Green” / “Sponge City” approach in stormwater management for adapting to climate change in Hong Kong.

INTRODUCTION

2. “Blue-Green” / “Sponge City” is a modern stormwater management approach to help solving drainage problems, fully utilise land resources and promote sustainable development. To combat climate change, Drainage Services Department (DSD) encourages the adoption of “Blue-Green” / “Sponge City” concept in new developments for more effective drainage and rainwater reuse. This concept can enhance urban flood resilience by the principle of infiltration, detention, storage, purification, reuse and discharge. To materialize the concept, DSD seeks to revitalise water bodies, construct flood retention lakes, and apply sustainable drainage elements such as green roof, porous pavement, etc. in urban development.

CLIMATE CHANGE MITIGATION AND ADAPTION

3. Hong Kong is on the common track of tropical cyclones. It is one of the cities with the highest rainfall in the Asia Pacific region with an average annual rainfall of about 2,400 millimetres. Under this climatic setting, Hong Kong always experienced substantial flooding in the past. Since the establishment of DSD in 1989, it has been striving to prevent flooding by adopting a three-pronged approach: stormwater interception, flood storage, and drainage improvement. This approach is proven effective in mitigating the impact of rainstorm and flooding hazards, resulting in reducing the

number of flooding blackspots in the city from 90 in 1995 to 6 in 2018.

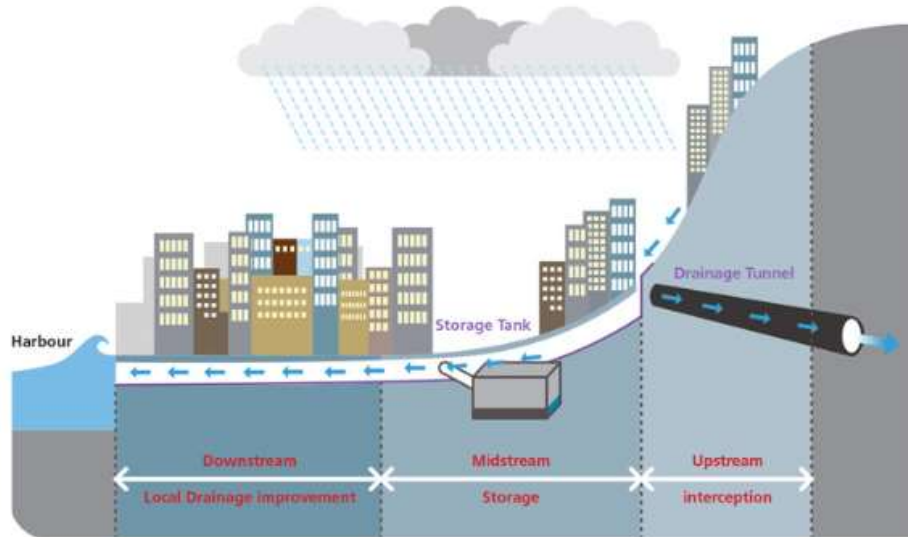


Figure 1 - Three-pronged Flood Prevention Strategies

4. As global climate change worsens, sea level rise will be accelerated, extreme torrential rains and storm surges will become more frequent. Hong Kong has to make more new attempts to tackle these challenges for flood prevention in the future. To support the sustainable development of Hong Kong and combat the climate change, in addition to jointly tackle the impact of climate change with other government departments by participating in the Inter-departmental Climate Change Working Group on Infrastructure, and reviewing the Drainage Master Plans (DMPs) of various districts, DSD adopts the “Blue-Green” / “Sponge City” concept of “following the nature with resilience” when planning and constructing new drainage facilities. For instance, green roofs and porous pavements are included in DSD facilities to facilitate infiltration and reduce surface runoff. Leisure facilities with stormwater storage capacity, such as riverside parks and flood retention lakes, are also planned to reduce water flow and achieve the effect of flood storage and detention, while stormwater harvesting systems are in place to reuse rainwater to optimise water recycling across the city and enhance the flood resilience level of the city.

“BLUE-GREEN” / “SPONGE CITY” CONCEPT

5. In mainland China, “Sponge City” means that a city could function like a sponge that has great “resilience” to environmental changes and natural disaster. The stormwater could be absorbed, stored, infiltrated and cleaned during rainy days, and could be “released” and utilised as needed to enhance the ecological function of the city and reduce the flooding in the city.



Figure 2 - Schematic Drawing of the “Sponge City” concept

6. In Hong Kong, DSD actively implements the concept of revitalisation of water bodies by building scenic environment with lush greens and pristine blues through “Blue-Green” Infrastructure, so as to offer more opportunities for the citizens to get closer to water bodies and learn to cherish natural resources. In fact, the concept of “Blue-Green” Infrastructure is similar to that of “Sponge City” and they share the same objectives. For simplicity, the term “Blue-Green” will be used hereafter to represent both “Blue-Green” and “Sponge City”.

7. “Blue-Green” is a modern stormwater management approach which allows the city to collect rainwater and use the stored rainwater when needed. This concept advocates reducing urban development through natural drainage of rain to avoid largescale artificial channel improvement works.

PROJECTS WITH “BLUE-GREEN” INFRASTRUCTURES IN HONG KONG

8. The following projects vividly illustrate the result of the “Blue-Green” concept in practice:

(a) *Underground Stormwater Storage Scheme*

The principle of underground stormwater storage scheme is to temporarily store stormwater during heavy rainstorm in an underground tank, thus relieving the burden of downstream drainage system. When the stormwater in the downstream drainage system recedes, the stormwater stored in the tank will be discharged to relieve storage space for the next rainstorm. Currently there are three underground stormwater storage tanks located at Tai Hang Tung, Sheung Wan, and Happy Valley.

The Happy Valley Underground Stormwater Storage Scheme, commissioned in 2017, is one example of realising such “Blue-Green” concept. Built under the Happy Valley Recreation Ground, the storage tank has a total capacity of 60,000 cubic metres for runoff storage during heavy rainstorms. This scheme not only achieves low-impact urban development and land co-use concept, but also avoids the large-scale downstream drainage improvement works. This is also the first flood prevention project in Hong Kong to combine the use of Movable Weir and Supervisory Control and Data Acquisition (SCADA) System.



Figure 3 - Happy Valley Underground Stormwater Storage Tank

(b) Green Roof and Vertical Greening

DSD has built a total of 30,000 square metres of green roofs and vertical greening within its own facilities including sewage treatment works as well as sewage and stormwater pumping stations, and continued to build 4,000 square metres of green roofs and vertical greening each year.



Figure 4 - Green Roof at Kowloon City No. 2 Sewage Pumping Station



Figure 5 - Green roof at Shatin Sewage Treatment Works

(c) River Revitalisation

For some river training works such as the Ho Chung River, Lam Tsuen River, Shenzhen River and Kai Tak River, in addition to upgrading drainage capacities, greening, ecological conservation and water landscape elements have been incorporated into the projects. They include

preserving the rivers' natural habitat, installing fish shelters, deflectors and boulders in the riverbed to improve microhabitats and biodiversity, etc. For the Shenzhen River Regulation Project, a flood retention lake was constructed on Shenzhen River not only to provide a habitat for wildlife that greatly enhances the river's ecological value but also to help store floodwater, thus keeping the downstream water level under control.



Figure 6 - Shenzhen River Regulation Project



Figure 7 - Fish ladder at Upper Lam Tsuen River

(d) Rainwater Harvesting System

DSD has also implemented Rainwater Harvesting System at Lai Chi Kok Drainage Tunnel and Happy Valley Underground Stormwater Storage Scheme. The harvested rainwater can be used for irrigation, toilet flushing and cleaning after suitable treatment as far as possible to save precious water resources.

(e) Green Building

Located at Kai Tak, Kowloon City No.1 Sewage Pumping Station is designed to incorporate a number of green building concepts, including green roofs, porous pavement, rain gardens and water harvesting facilities. It is the first government infrastructure to be bestowed the highest Final Platinum Rating under BEAM Plus Assessment for New Buildings.



Figure 8 – Kowloon City No.1 Sewage Pumping Station

SHAPING HONG KONG WITH MORE “BLUE-GREEN” ELEMENTS IN FUTURE

9. Apart from embodying the concept of “Blue-Green” in existing drainage facilities, in the future, DSD also actively introduces “Blue-Green” design elements to the new projects.

(a) The First Flood Retention Lake in Hong Kong

In the Development of Anderson Road Quarry Site, we will have the first flood retention lake in Hong Kong. The flood retention lake serves flood control, leisure and rainwater harvesting functions. It will store stormwater during heavy rains to reduce the flood risk downstream, and some of the lake water will be used as irrigation and other non-potable purposes after suitable treatment. This project also provides scenic waterscape environment to residents for public enjoyment.



Figure 9 – Flood Retention Lake at the Development of Anderson Road Quarry Site

(b) The First River Park in Hong Kong

With the Tung Chung New Town extension under way, the Government has seized the opportunity to revitalise a section of the existing Tung Chung River, upgrading its drainage capacity and transforming it into the first river park in Hong Kong. The river park is poised to be green and water-friendly for residents who enjoy water sports and natural sceneries.

10. To combat climate change, DSD will continue to promote and implement “Blue-Green” Infrastructure. While harvesting stormwater and conserving the nature, DSD endeavours to improve the citizens' living environment in tune with the surrounding natural and heritage setting.

**Drainage Services Department
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