Greening Initiatives in Public Rental Housing Estates

Dennis Yip

1.0 Evolution of greening over the past 50 years

2.0 Latest Greening Initiatives

3.0 Research Studies

4.0 Promotion & Community Participation

Evolution of greening over the past 50 years

Evolution of greening over the past 50 years

1950s

Lok Fu Estate

Shek Kip Mei Resettlement Estate (1954)

1960s

- Minimum provision of greenery.

Fuk Loi Estate (1963)

Tai Hang Tung Estate (1968)

Evolution of greening over the past 50 years

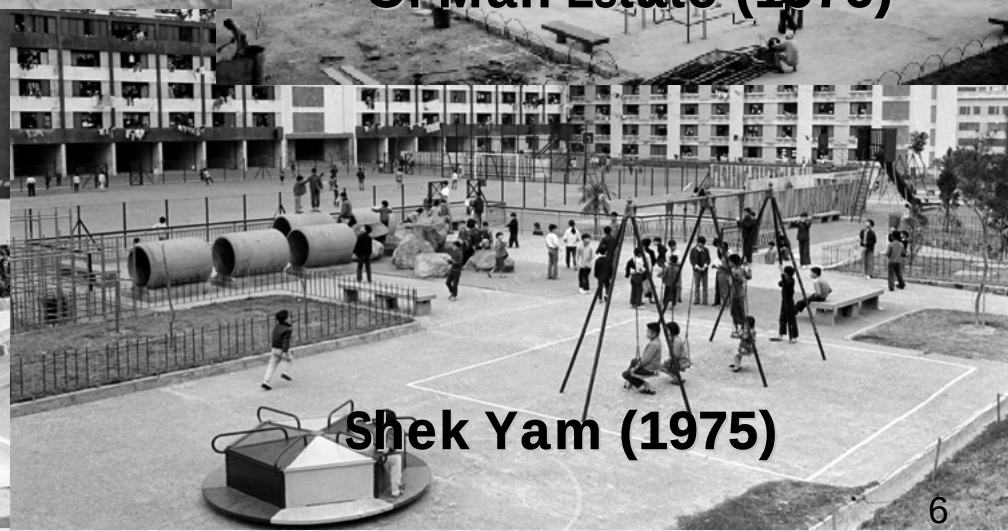
1970s

Wang Tau Hom (1975)

- HKPSG was promulgated in 1974.

Oi Man Estate (1976)

Shun Lee Estate (1972)



Shek Yam (1975)

1980s

Choi Ha Estate (1989)

Fung Shing Court

There was a greater variety of external works design.

Evolution of greening over the past 50 years

1990s

Ho Ming Court

- Each estate has a unique theme and special landscape character.

Heng On Estate

2000s

Soft landscape works plays an important role in the design of ext. works.

Un Chau Estate (2008)

Greening coverage has been increased to at least 20%.

SMP South Estate (2009)

2010 onwards

- Create a 'Home in the Park'.
- Design becomes more humanistic.
- Create a sense of identity and a community with neighborhood spirit.

Kai Tak Estate (2013)

2010 onwards

- High percentage of greenery
- Sustainable design in terms of environment and culture, catering for the needs and interests of all age groups.

Kai Tak Estate (2013)

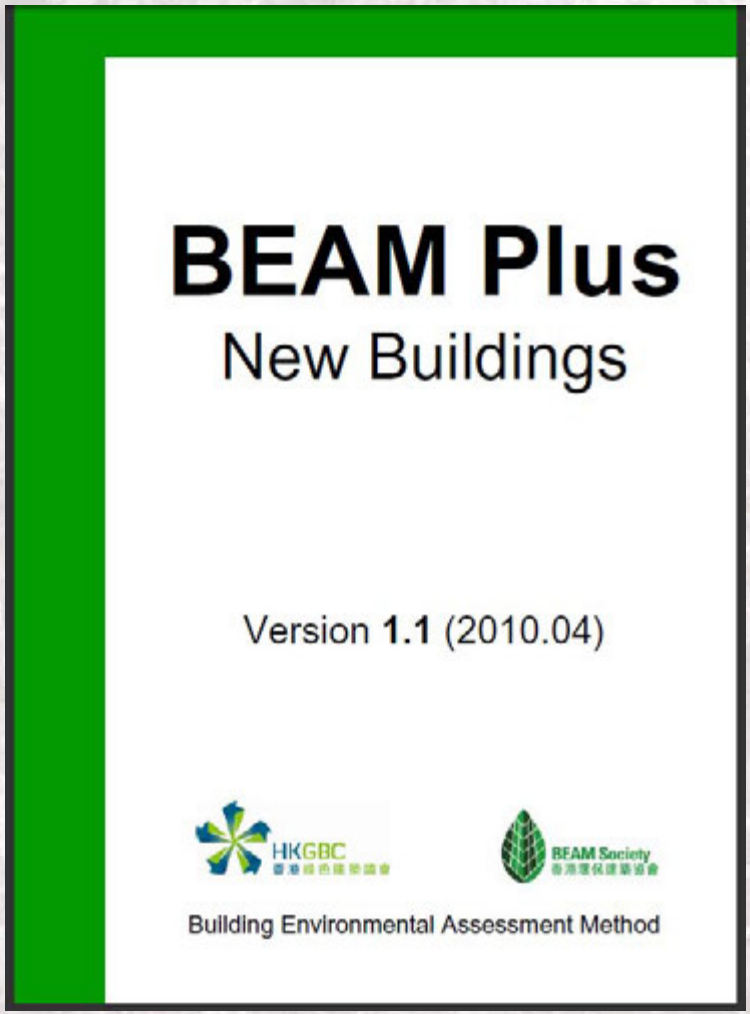
Greening Target

- In line with Chief Executive's 2009-10 Policy Address, *"Increase the greening ratio of all new public rental housing estates to **at least 20%.** We will also provide **green roofs** in low-rise buildings and provide **vertical greening** in some pilot projects wherever feasible."*

  the greening coverage ratio has been increased to at least 20%

- Aim to achieve an overall target of 30%.
- Plant a minimum of 3 trees per 100m^2 of the total site green coverage
- Plant at least 1 tree per 15 built flats





BEAM Plus

(Building Environmental Assessment Method)

Greenery has an important role to play

Prerequisite

It is required to demonstrate compliance with at least 20% greenery of the site area.

Credit Requirement

Hard Landscaping

1 credit for using pervious materials for a minimum of 50% of hard landscaped areas.

Soft Landscaping

1 credit for providing at least 30% of the site area.

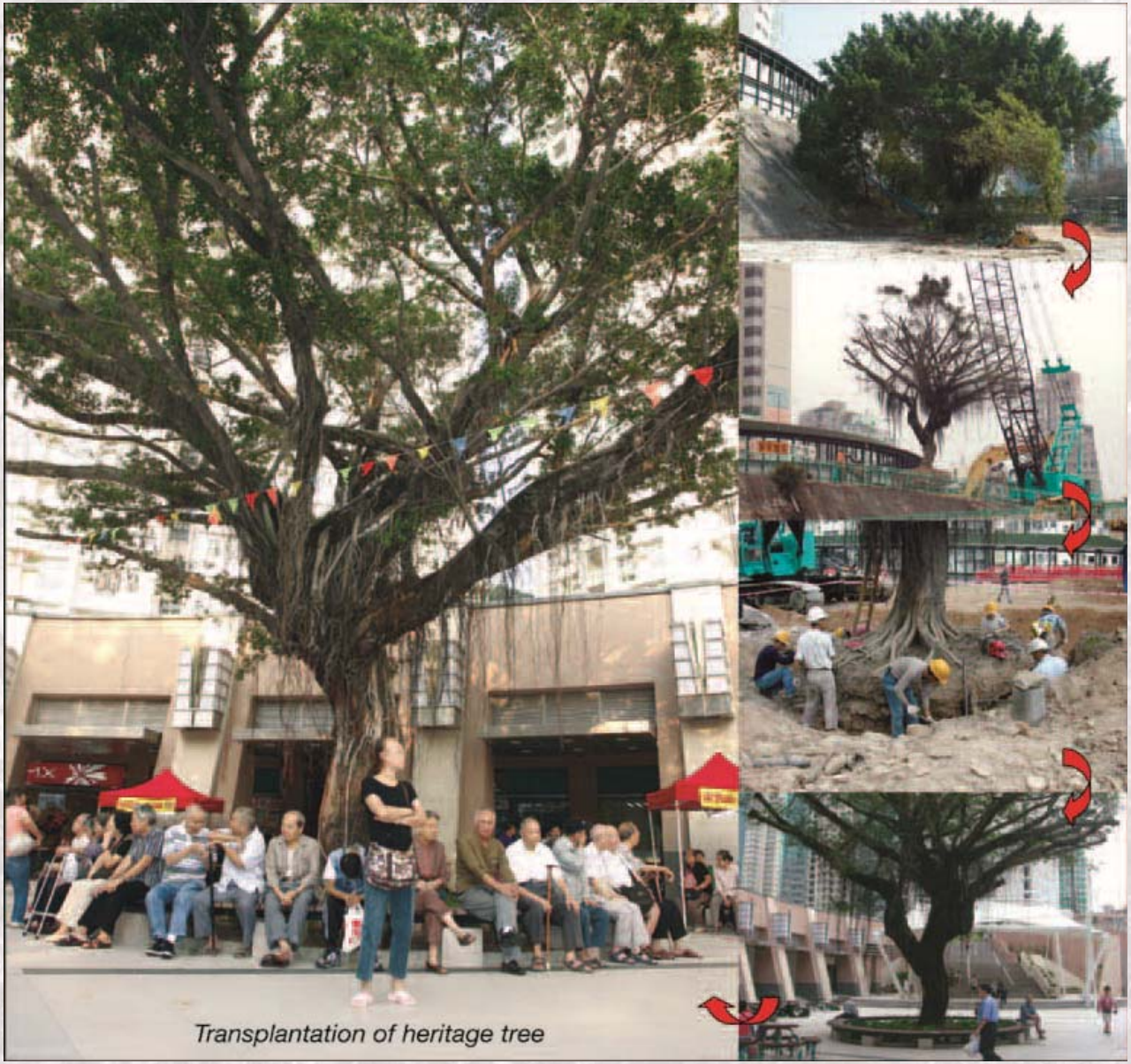
2 credit for providing at least 40% of the site area.

Greening Measures in new PRH Estates

A. Provide more planting at grade and slope areas;
B. Provide green roof;
C. Provide grass-paving system; and
D. Implement vertical greening

Tree has the highest greening benefits for direct enjoyment by residents

Sau Mau Ping Estate



LA assess each tree on construction site and ensure that all tree with high amenity will be retained or transplanted.

Upper Ngau Tau Kok Estate

We Transplanted 42 Trees. Major Transplanting of Celtis Sinensis at Main Entrance

Rejuvenated its life as focal point of CPA

Preserved trees at original position

	At-Grade	On Slope	Total
Existing Trees	83	208	291
Retained Trees	15	114	129
Transplanted Trees	40	2	42

Total no. of Trees Preserved 171 = 59%

Maximize Tree Preservation Through 2200m² Concrete Grillage

Existing slope

Concrete grillage during construction

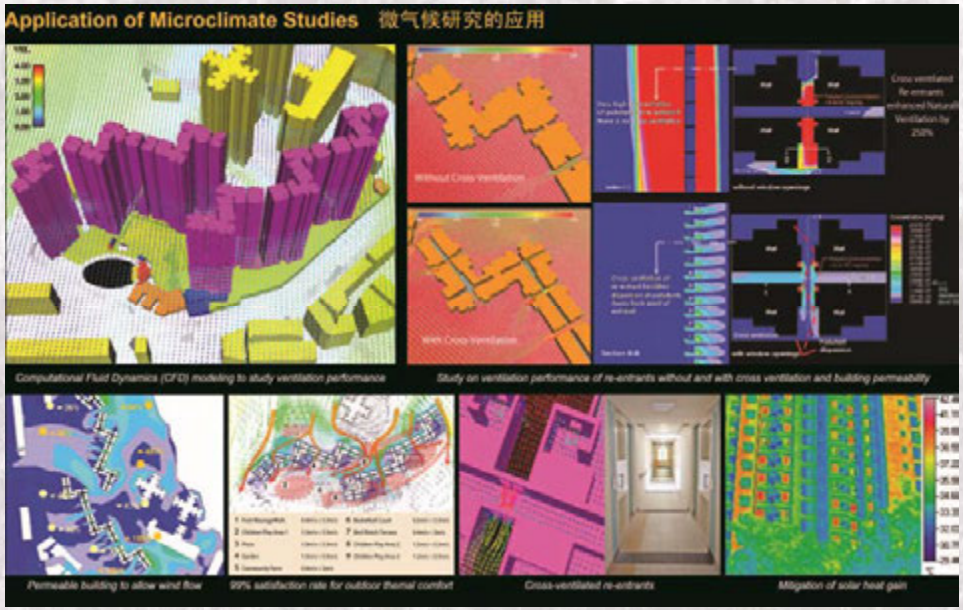
Concrete grillage with existing trees

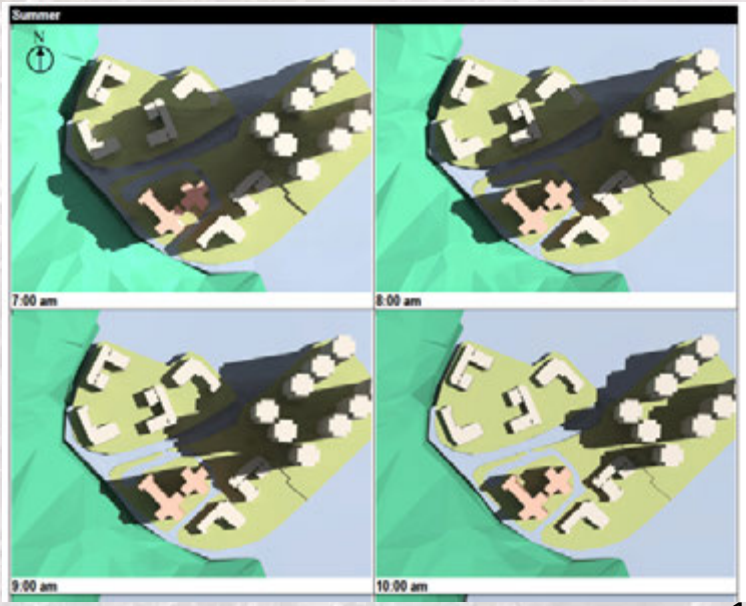
Concrete grillage completion

$$\frac{\text{Preserved trees } 114}{\text{Existing trees } 208} = 55\% \text{ tree retained}$$

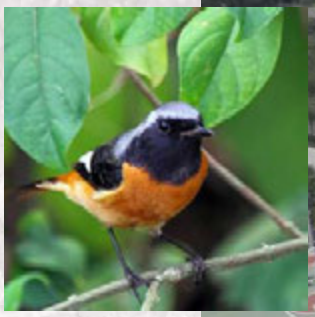
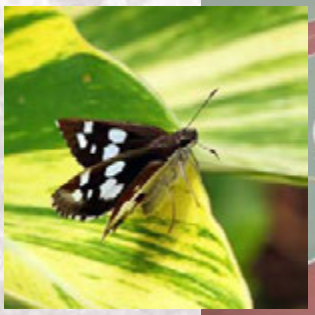
‘Micro-climate’ Studies

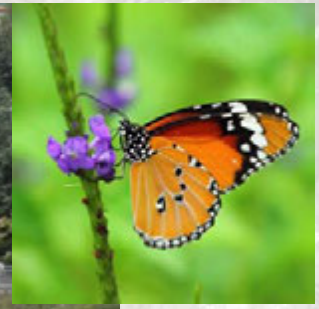
- HKHA pioneered the application of micro-climate studies in the site planning and design from inception and post-occupation stage.
- Studies aim to evaluate the environmental performance such as local wind direction, natural ventilation, pollution dispersion, daylight & sun-shading and thermal comfort of the living environment, in order to enhance design, orientation and disposition of the housing blocks;
- Since 2004, over 35 projects have adopted the studies.

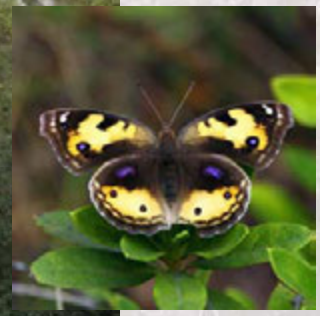




Maximize plantings on slope to reinstate the natural habitat & blend in with the surrounding natural environment





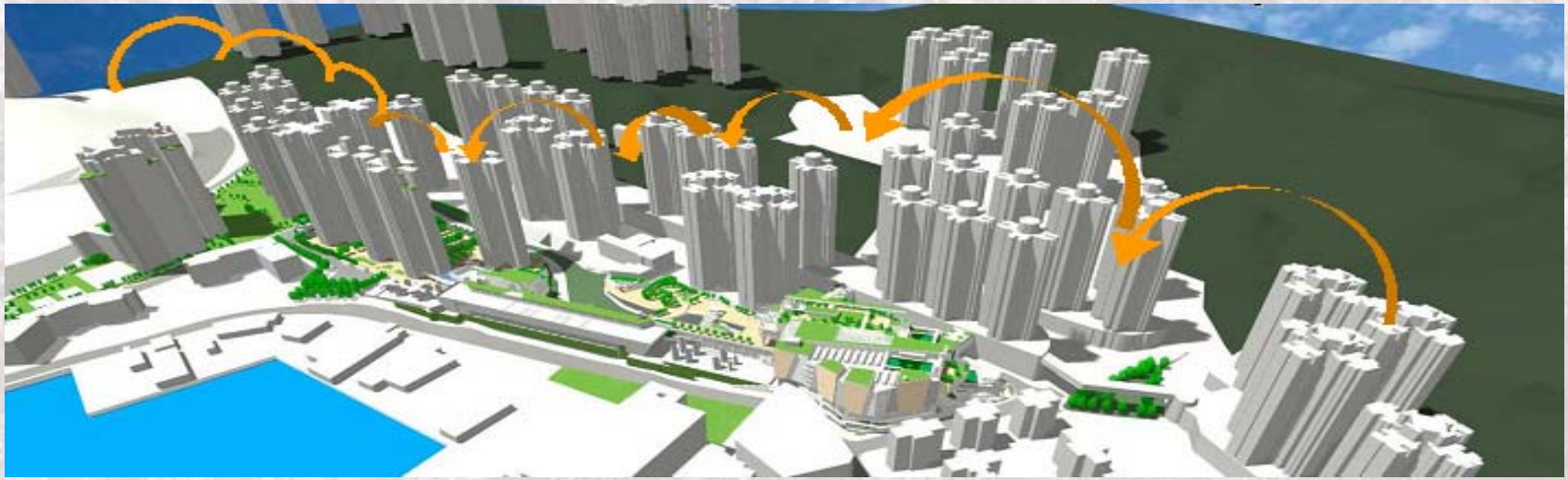
Slope planting at Sau Mau Ping South Estate

Ecological Assessment

- During site feasibility stage, ecological consultant is appointed to conduct an ecological assessment to formulate an ecological master plan for the district;
- With a view to providing a long term vision to realize sustainable greenery linking the ecosystem between the development and the surrounding.

Scope of works includes

- Analysis of the opportunities for enhancement
- Ecological baseline survey of the selected site;
- Formulation of the enhancement plan;
- Inspection during the implementation stage;
- Ecological monitoring; and
- Conclusions and Recommendations



We transform 7200m² chunam slope into Eco Garden

Additional native planting for eco balancing

Types of Native Species	Planting Quantities
3 Standard Trees	63
19 Whips	4037
11 Shrubs	21,990

Reformed 30⁰ fill slope

Full turfing on new slope

- An Eco-garden by planting with native species was introduced in the Sau Mau Ping Estate (Phases 13 & 16) to enhance the ecological resources in the vicinity of Sau Mau Ping.
- The project was completed in Feb 2010.

Bio-diversity

Use of those species of plants that have a **natural affinity** for the local area laid out on the basis of bio-diversity. The planting is supposed to engender **good habitats** for **insects, birds and other kinds of animal life**


Acronychia


Acronychia pedunculata


Celtis sinensis


Elaeocarpus chinensis


Litsea glutinosa


Machilus sp.


Spotted Dove


Japanese White-eye


Black-necked Starling


Common Grass Yellow


Red-base Jezebel

Planting with its **seasonal variations** will impose a **rhythmic experience of time**

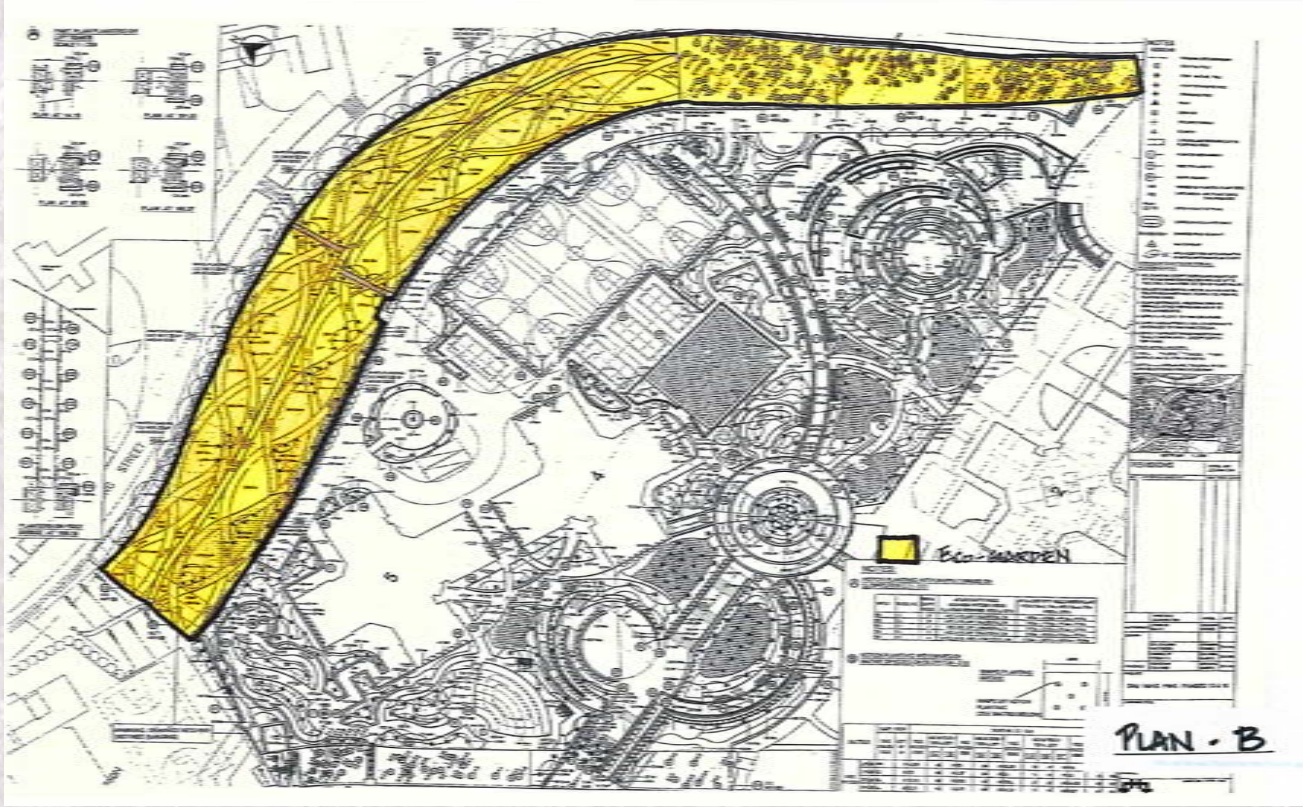
Nature's cyclical processes find their expression in the **community** and becomes a vital part of housing quality

Findings:-

- The difference in records of butterfly between enhancement areas and control sites was very contrasting;
- Bird species richness in the enhancements areas was 2.7 time higher than those in the control sites;

Slope planting

at Sau Mau Ping South Estate



Plants attracting butterfly:

Nectar Plants for Butterflies

Many flowering plants in urban parks provide nectars for butterflies. However, about half of Hong Kong's butterfly species, especially Nymphs and Browns, seldom or never visit flowers for nectar.

Coral Hibiscus (*Hibiscus schizopetalus*)
Flowering from May to October, attracts large Swallowtails, Whites and Yellows

Chinese Ixora (*Ixora chinensis*)
Flowering from June to October, attracts Swallowtails, Whites and Yellows

Pentas (*Pentas lanceolata*)
Flowering from March to November, attracts Swallowtails, Whites and Yellows

Golden Dewdrops (*Duranta erecta*)
Flowering from May to November, attracts Skippers, Blues, small Whites and Yellows

Wedelia (*Wedelia trilobata*)
Flowering almost throughout the year, attracts Skippers, Blues, small Whites and Yellows

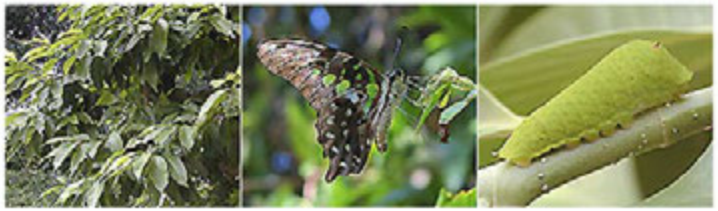
Lantana (*Lantana camara*)
Flowering almost throughout the year, attracts Swallowtails, Skippers, small Whites and Yellows and some Nymphs

http://www.lcsd.gov.hk/green/butterfly/en/section6.php

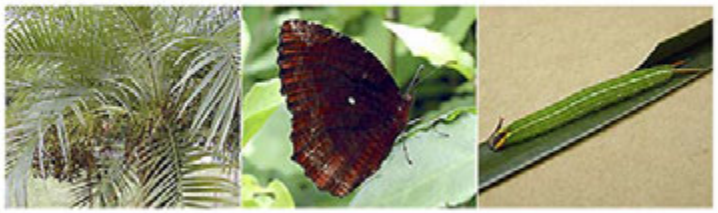
Plants attracting butterfly Larvae:

Food Plants for Butterfly Larvae

Different species of butterfly larvae feed on different plant species. More butterfly species can normally be found at places with a wide variety of plant species. Since many plants growing in urban parks are the food plants for butterfly larvae, these parks become the breeding sites for certain species of butterflies.



White Jade Orchid Tree (*Michelia alba*)
Fed on by larvae of *Graphium agamemnon and Graphium doson*



Dwarf Date Palm (*Phoenix roebelenii*)
Fed on by larvae of *Elymnias hypermnestra and Suastus gremius*

Banana Shrub (*Michelia figo*)
Fed on by larvae of *Graphium agamemnon and Graphium doson*

Camphor Tree (*Cinnamomum camphora*)
Fed on by larvae of *Graphium sarpedon and Charaxes bernardus*

Spider Tree (*Crateva unilocularis*)
Fed on by larvae of *Hebomoia glaucippe*

http://www.lcsd.gov.hk/green/butterfly/en/section5.php

Greening Measures in new PRH Estates

A. Provide more planting at grade and slope areas;

B. Provide green roof;

C. Provide grass-paving system; and

D. Implement vertical greening

Production Period	No. of estates with Green Roof	Green Roof Area (m^2)
2007/08	2	420
2008/09	7	3,600
2009/10	11	2,400

Roof Greening at Yau Tong Estate Phase 4

Roof greening could effectively **reduce the surface temperature** as compared to hard roof surface. It reinforces building insulation and energy efficiency and **lowers the overall heat island effect**

- Provide green roofs in low-rise structures with extensive planting using different types of vegetation
- *6,000m^2* green roof installed since 2007

Roof Greening at Eastern Harbour Crossing Estate Phase 5

Kwun Tong Estate

Choi Wan Road DOS

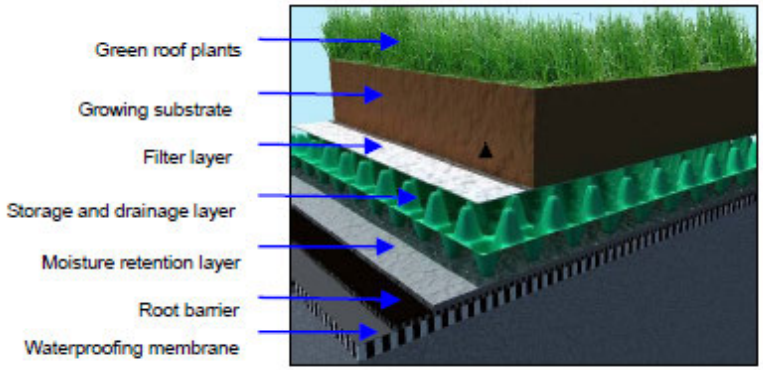
Examples of Green Roof Installation in PRH Estates
Three different types of vegetation used
Roof greening by grass ...

Choi Ying Estate

Tin Ching Estate

Examples of Green Roof Installation in PRH Estates

Roof greening by Sedum ...

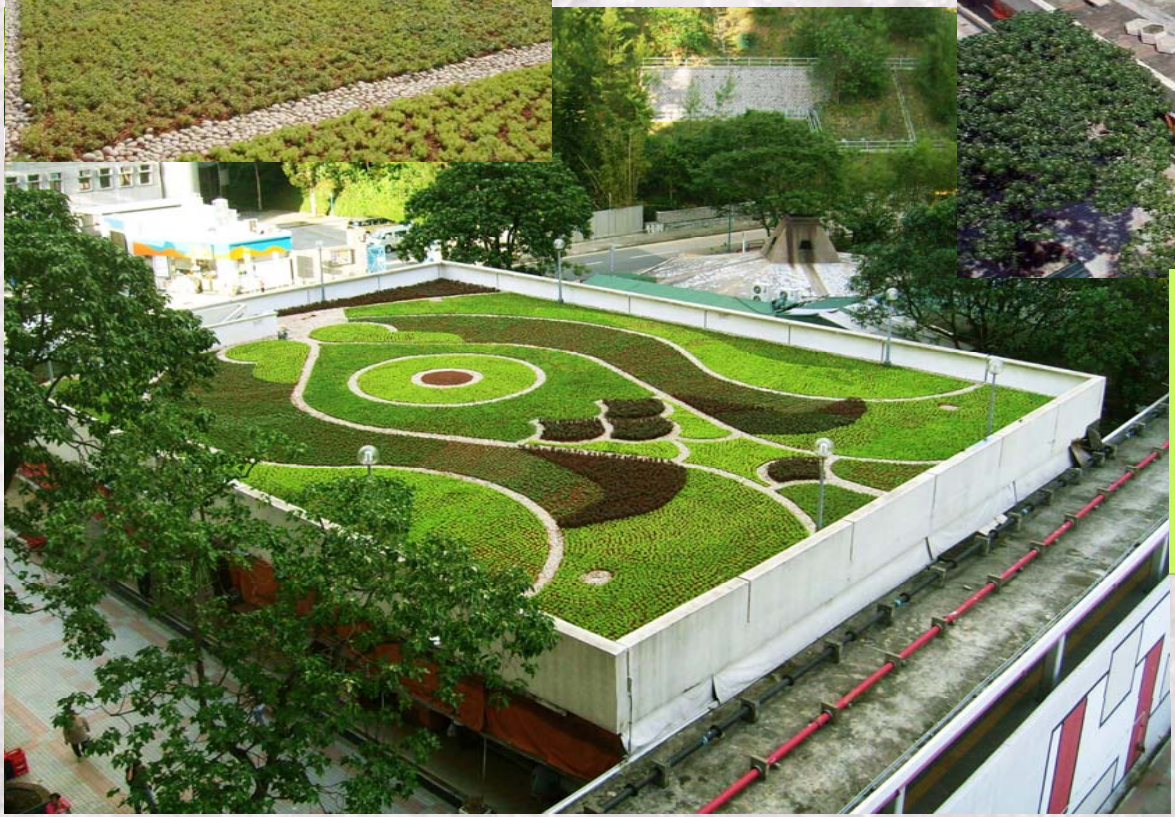


Typical section of green roof

238M Roof greening on covered walkway with semi-automatic irrigation

Roof greening by small shrubs & groundcovers ...

Examples of Green Roof Installation in PRH Estates
Roof greening by sedum & groundcovers ...



Fu Shan Market
Diamond Hill

Examples of Green Roof Installation in PRH Estates

Roof greening by **grass & groundcovers ...**

Lam Tin 7 & 8

Design Consideration/ Checklist for RG:

☑ The level of illumination affects the choice of plant.
For successful establishment of Sedum, the roof areas should have a minimum 4 hours direct sun light per day.

Arachis duranensis (蔓花生)

Liriope spicata(蒲草)

Nephrolepis exaltata (劍蕨)

Rhoeo discolour (蚌花)

Roof areas with minimum 4 hours direct sun light per day

Design Consideration / Checklist for RG:

- ☑ Structural loading
- ☑ Waterproofing and root barrier
- ☑ Drainage layer
- ☑ **Irrigation system**
- ☑ Microclimate
- ☑ **Growing medium/ substrate**
- ☑ **Maintenance Access**





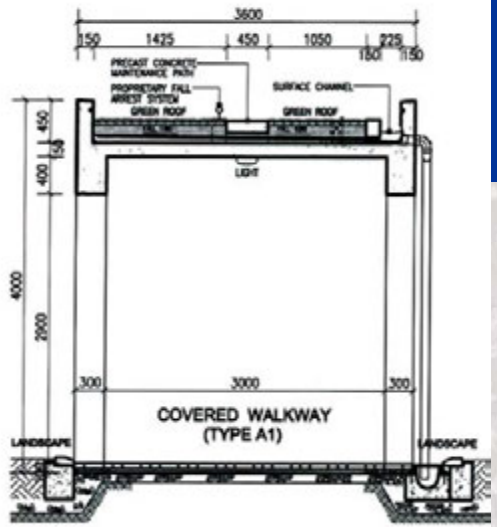


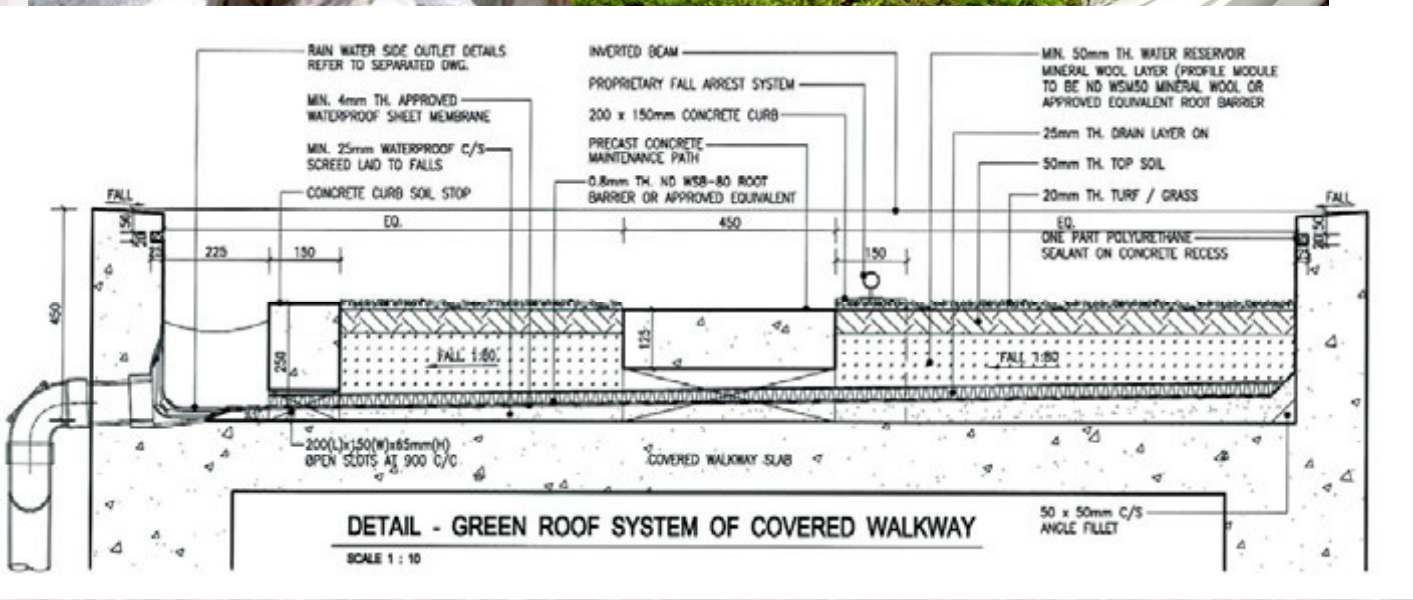


Design Consideration/ Checklist for RG:

☑ **Safety- Fall Arrest System**

☑ Future maintenance path





Design Consideration/ Checklist for RG:

☑ **Plant Selection**

Crytograuna crispa

Chlorophytum capense

Sedum kamtschaticum (三七景天)

Sedum mexicanum (金葉佛甲草)

Alternanthera versicolor

Adiantum capillus-veneris

Liriope spicata 'Variegata

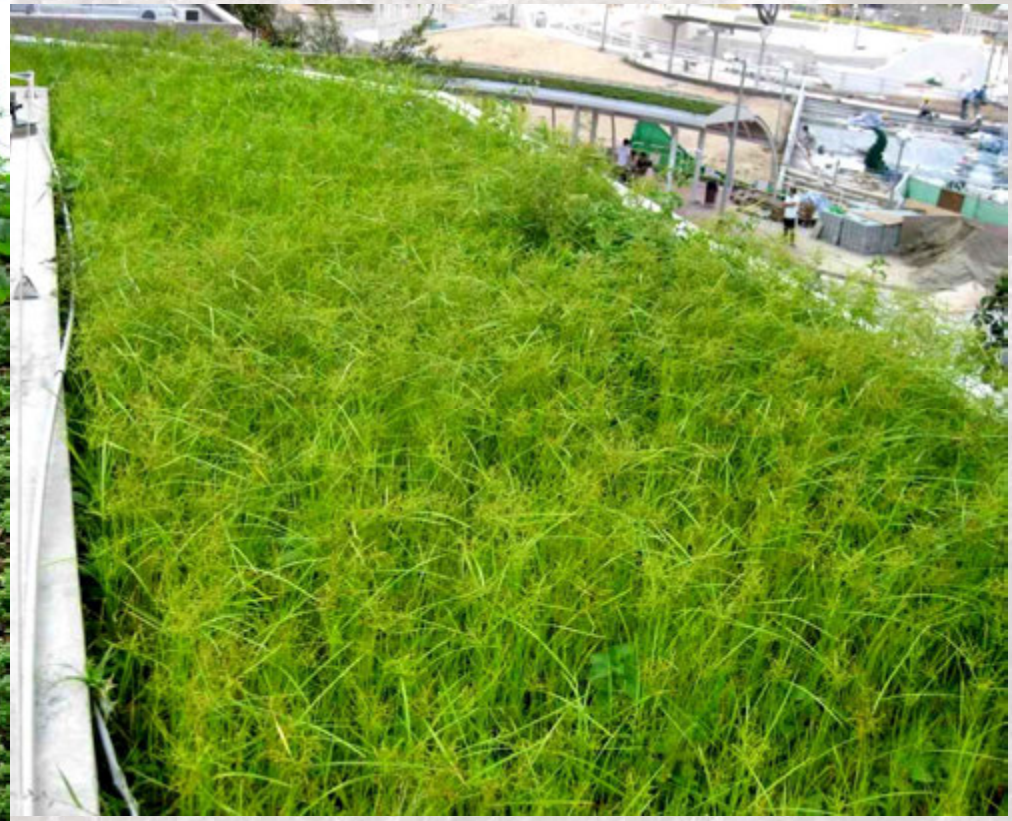
Duranta repens 'variegata'

Duranta repens 'Dwarf golden'

Arachis duraensis

Design Consideration/Checklist:

☑ **Future Maintenance - Weeding**



Experience Sharing - Key factors for Success

- Thoroughly and holistically investigate all site specific aspects of your green roof project e.g. structural capacity of the roof and waterproofing system, irrigation system.
- Clearly define your goal before getting into the design phase
  - Not all beneficial properties can be optimized at the same time
  - Maximizing visual attractiveness/Minimizing maintenance cost;
  - Creating a natural habitat/ using the roof as an amenity;
  - Maximizing water retention/ minimizing structural loading
- Consider site and green roof specific factors for plant selection
- Clearly define maintenance goals and procedures

Source: Peter M. Philippi – Selected Green Roof Projects from Germany and the US – Keyfactors for Success

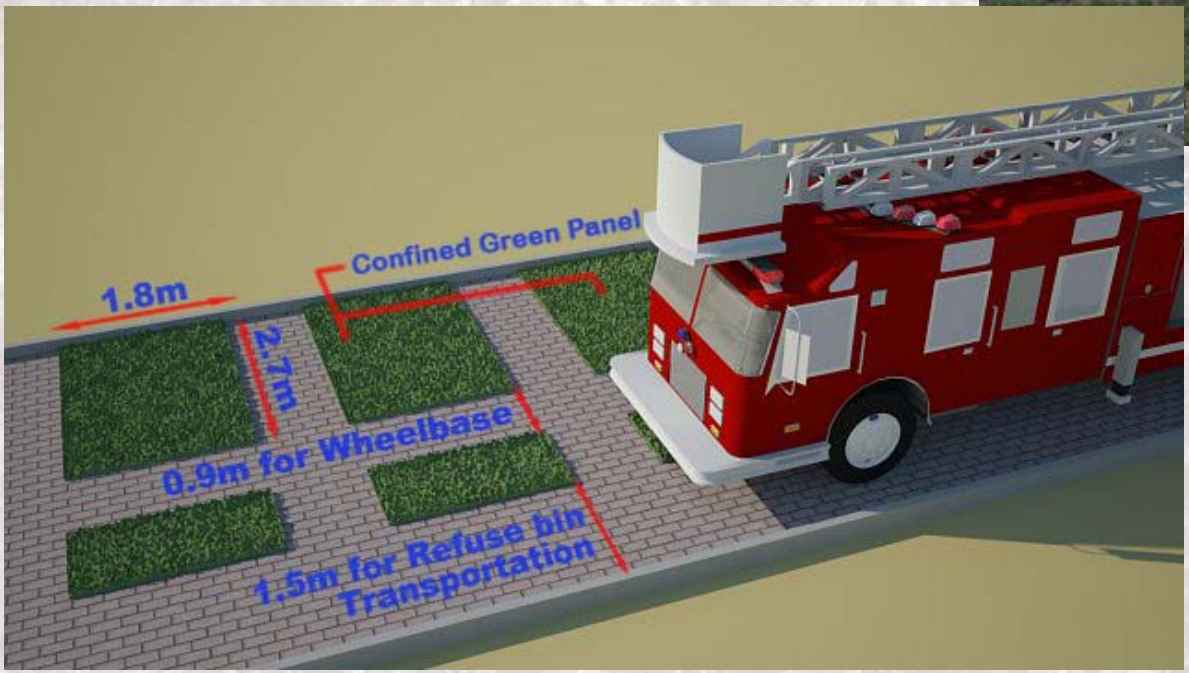
Greening Measures in new PRH Estates

A. Provide more planting at grade and slope areas;
B. Provide green roof;
C. Provide grass-paving system; and
D. Implement vertical greening




Grass-paving system could be installed in EVA .....

Kai Tak Estate Pilot Scheme



.....or in the driveway of external carpark.

Tin Ching Estate (2009)

Two Type of Construction:

1. **Insitu Concrete Grass Paving System (e.g. Grasscrete®)**
2. **Pre-cast system (plastic or precast concrete)**

In-situ method

Pre-cast method

1. Laying of plastic former

3. Melting out of former

2. Pouring of concrete

4. Ready for soiling & grassing

Design Consideration (EVA):

- Loading from fire engine
- Lateral force of wheels turning/braking
- Provide surface to suit both vehicular and pedestrian traffic (Uneven surface caused discomfort for pedestrian)
- Drain off surface water to prevent skidding
- Durability & maintenance

Kai Tak Estate Pilot Scheme

Greening Measures in new PRH Estates

A. Provide more planting at grade and slope areas;
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D. Implement vertical greening

Climbers with suckers on blank wall

Choi Ying Estate

Kwai Chung Estate Phase 1

Creepers on frame

12 months after planting

Choi Ying Estate

34 months after planting

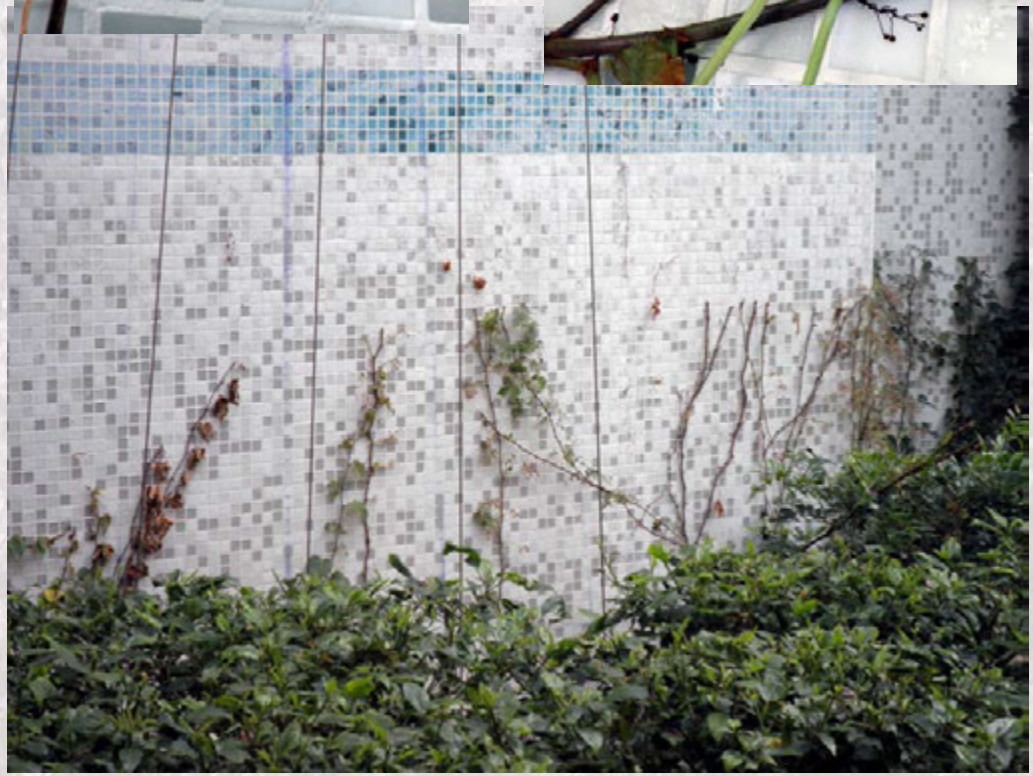
Translucent Vertical Green Barrier

Climber to from a translucent vertical green barrier

Climbers on Retaining Wall

Climbers on End Walls of
Domestic Blocks Lam Tin 7

Current Greening Initiatives



Vertical Green Panel

- Free-standing
- As visual barriers and noise barriers,
- Small vegetation planted on one side or both sides of the panels
- Automatic irrigation system incorporated

Interior planting face

Exterior planting face

Sau Ming Road Park – visual barrier

Vertical Green Panel

- High capital installation cost for the construction of the green panel;
- The green panels require higher regular maintenance .

Sau Mau Ping South Estate – noise barrier

Modular Vertical Green Panel

Characteristics:

- Green Panels with infill growing substrate to be prefabricated off-site
- Planted with selected small size vegetation before delivery to site
- Like cladding to vertical surface
- Automatic irrigation system incorporated

Tung Tau Cottage West

Kwai Chung Estate

Characteristics:

- High capital installation cost for the construction of climbing frame and the green panel;
- The green panel requires high maintenance including automatic irrigation and plant replacement;
- Three-dimensional planting to create a life arch-way to address park entrance.

Ma Hang Estate

Modular Vertical Green Panel

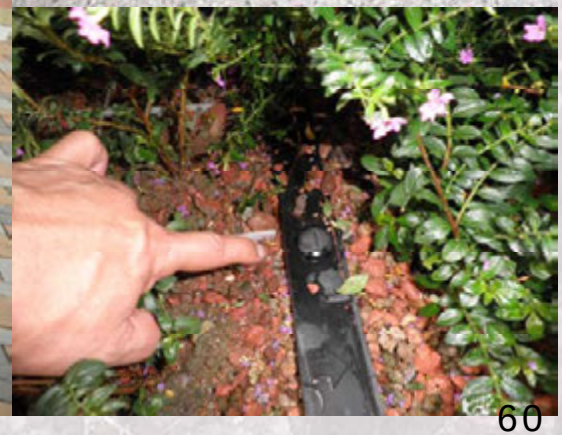
Modular Vertical Green Panel

Yau Lai Estate (EHC Site) Ph.4

Research Studies

A. Green Tray System
B. Greening Hoarding;
C. Vertical Green Panel Biotechnical Research
D. High-rise rooftop greening Biotechnical Research;
E. Recycling of Water
F. Tree Databank
G. Use of Renewable Energy

A. Green Tray System



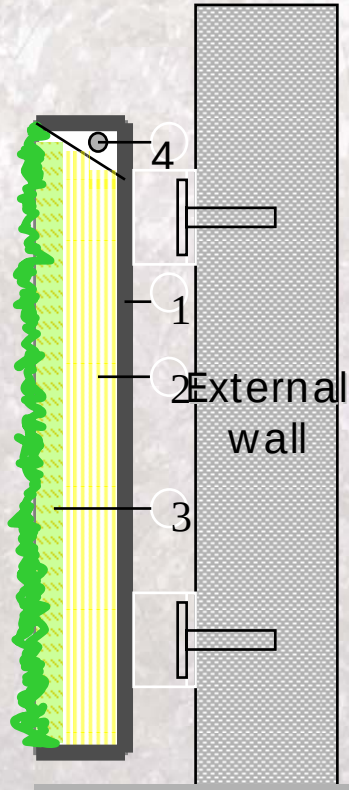
B. Green Hoarding

- enhance aesthetic value
- Improve air quality
- providing dust and noise screening
- demountable and reusable,
- readapt as permanent green wall

C. Vertical Green Panel Bio-technical Research

Schematic Section of Modular Green Panel

1. Aluminum tray overall size 500 x 1000mm
2. 50 mm thick growth medium
3. 25 mm thick soil and grass turf (Zoysia japonica , 朝鮮草), each weight around 15 Kg.
4. Built-in automatic irrigation system

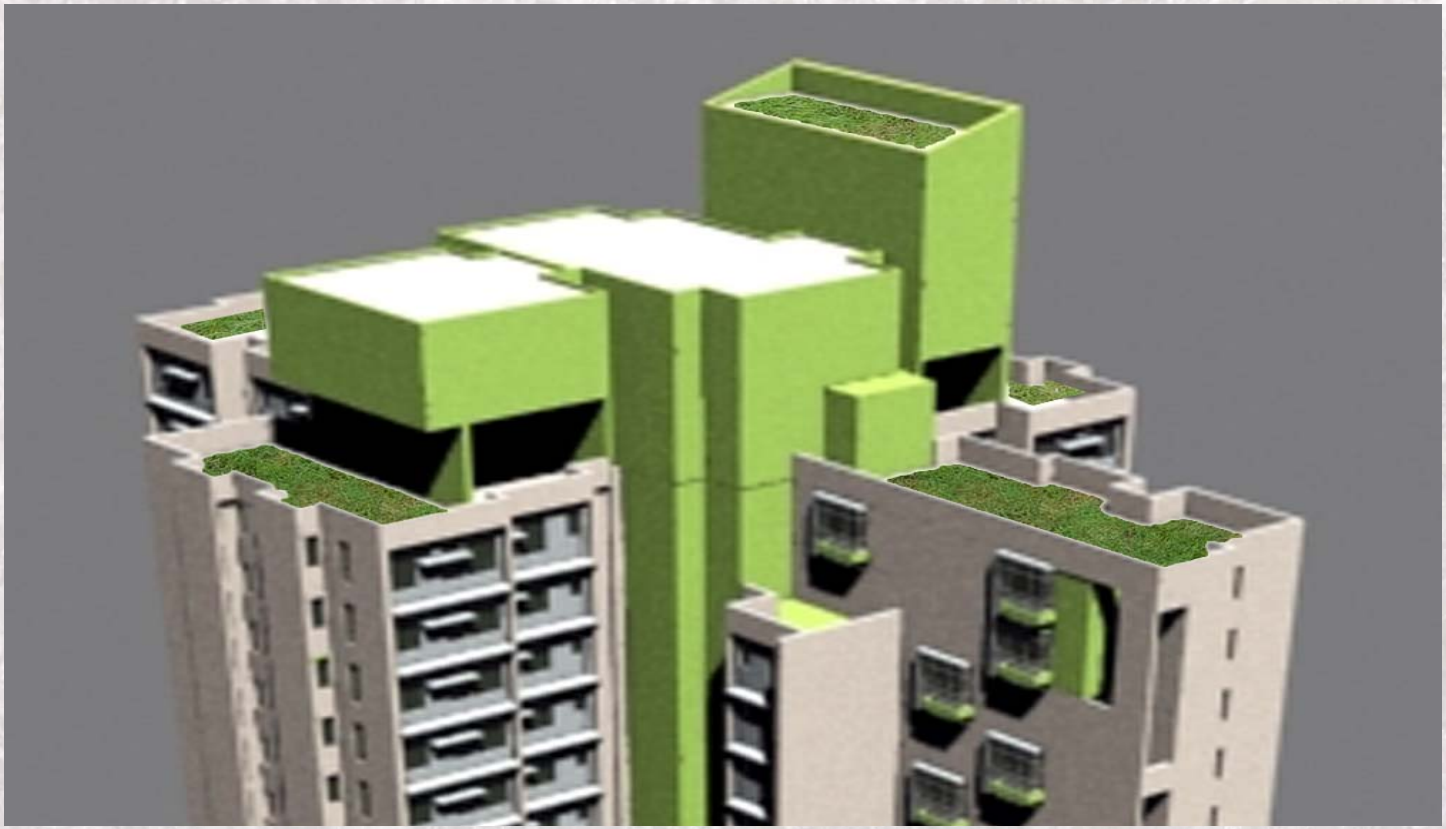


Schematic Section of VGP

D. High-rise Rooftop Greening Bio-technical Research

- **Energy efficient greening –**

  HA will soon commence a study on roof greening technologies targeting at high-rise residential blocks. The objective is to assess the effect of plant species on the thermal and energy performance.

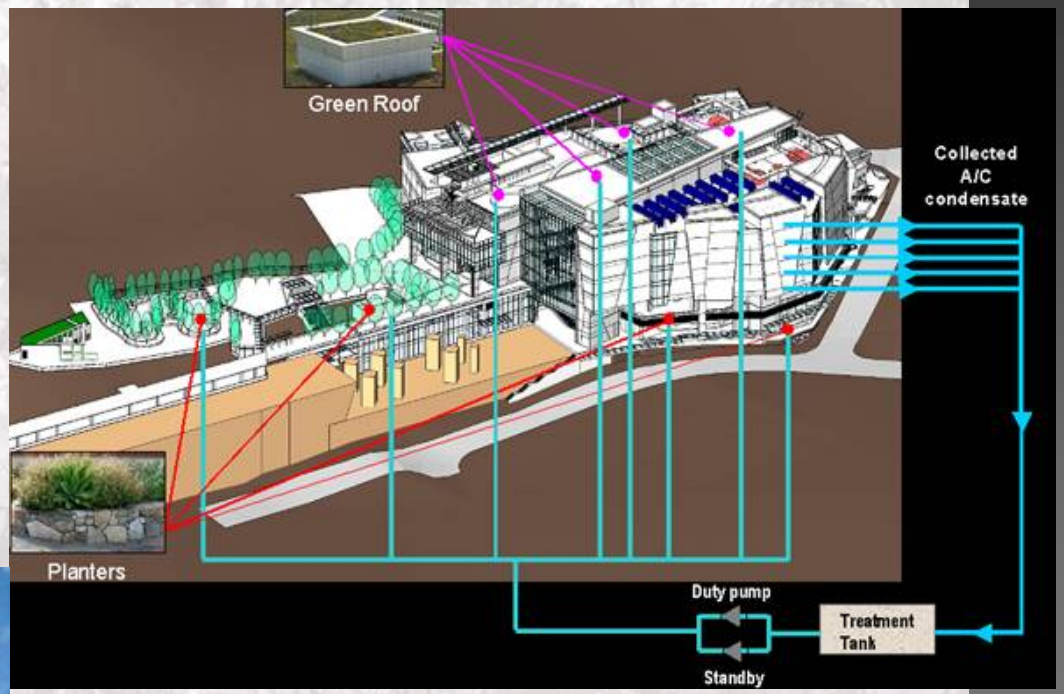


E. Expand sustainable sources of recycled water

EHC 6 and YT 4

will work as **reservoirs of reclaimed water** to irrigate both extensive and intensive greening over these sites.

- **annual reduction in water consumption of 9,263m3**
- **65%** of the total irrigation amount required per year.

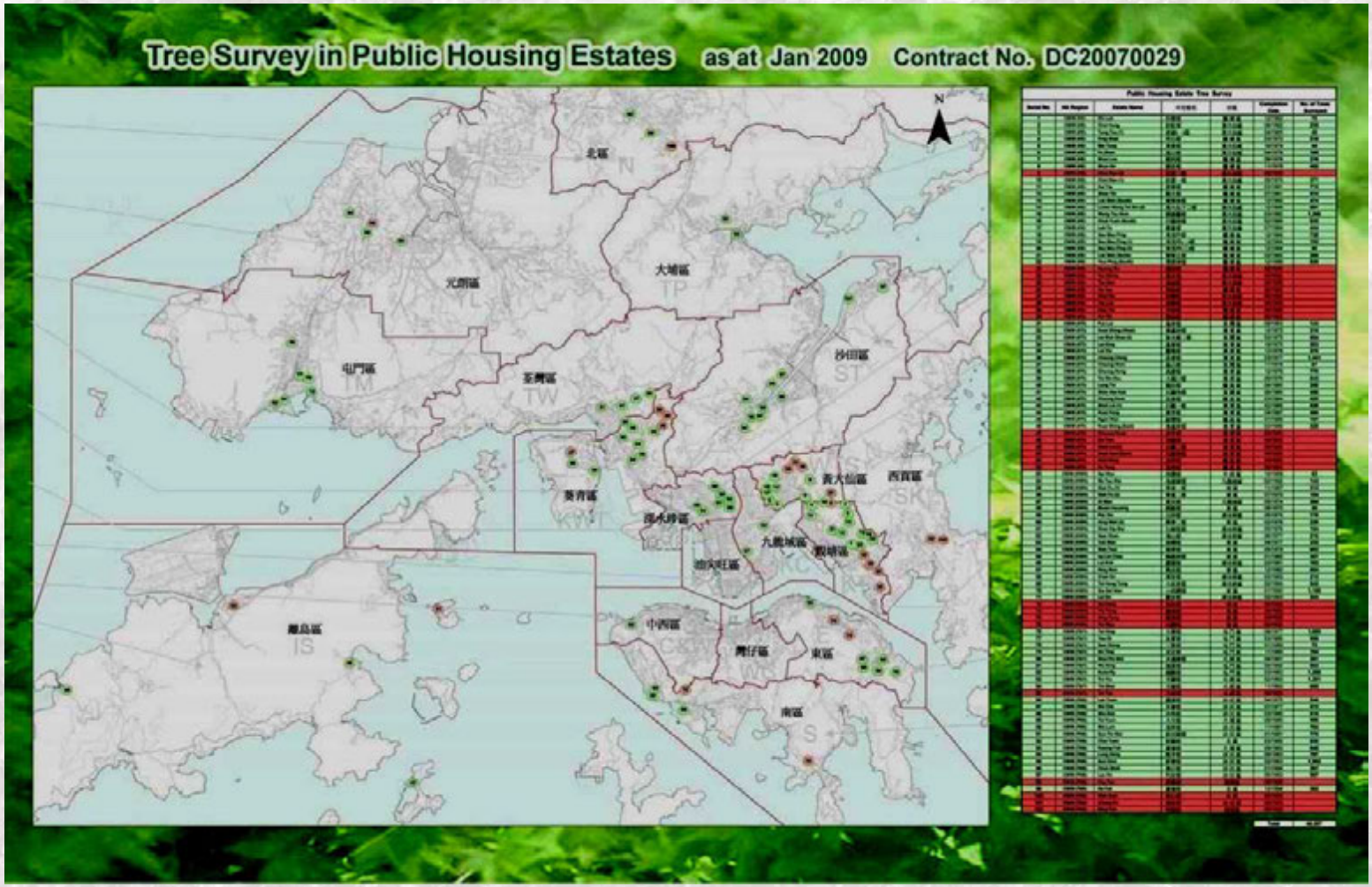


Reclaimed water system for YT 4

E. Expand sustainable sources of recycled water

F. Establishment of Tree databank for better Tree Management

HD carried out a pilot study of the use of Geographic Information System (GIS) on the tree inventory management for 2 existing estates.



G. Use of Renewable Energy

Generate Renewable Energy for LED Lighting over 850m² Open Space with Educational Value and Estate Identity

Promotion and Community Engagement

- **Green Delight and Green Ambassadors**
- **Action Seedling Activities**
- **Community Gardens**
- Tree Trail

Promotion and Community Participation

- Fostering sense of belonging and **ownership.**
- Engagement workshops with the adjacent schools.
- Growth medium and plants were assembled by students for establishment and care.
- Established panels relocated to the site office as green roof.





foster participation **Ownership and identity** **engage the community**

Design for Pictorial Image of VGP



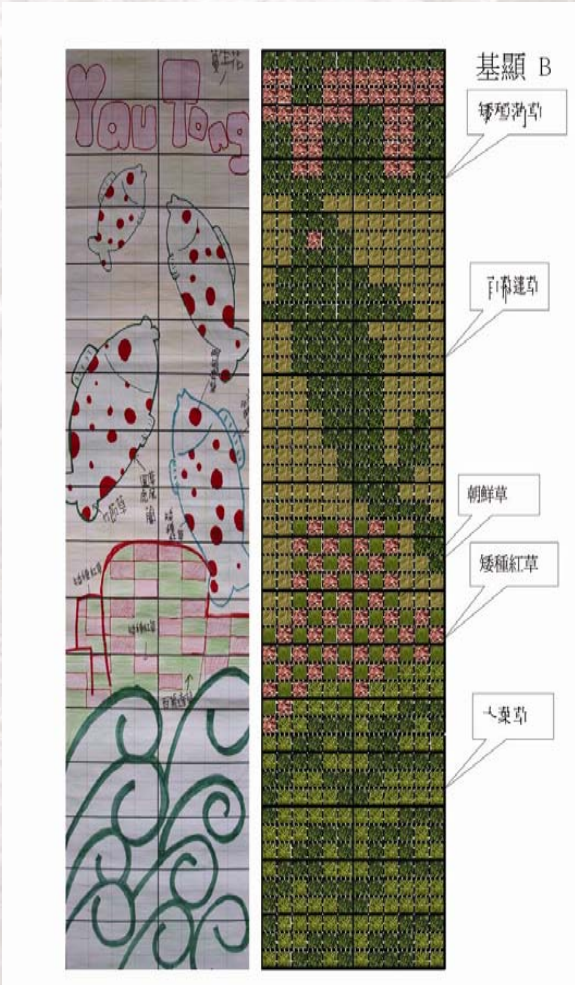









Design for Pictorial Image of VGP



Winners

Winners' artworks planted and installed at the feature walls and facade of lift tower.

Yau Lai Estate (EHC Site) Ph.4


Thank You