

SKYRISE GREENERY SHOWCASE

3rd Edition

**Part 1:
Commercial, Residential
& Community Facilities**



Foreword

Skyrise greenery refers to both rooftop and vertical greenery, strategically used and adapted by building owners, architects and contractors as a nature-based sustainable solution to enhance the built environment, reduce energy usage, attract biodiversity back into the city and extend greening efforts skywards. This multi-tiered greening strategy of facades, balconies, mid-level, and topmost roof spaces helps to optimise urban spaces for greenery and recreation, enhancing urban dwellers' quality of life through their work and living environment.

As Singapore transforms into a City in Nature where nature is further restored into the built environment with greenery, incorporating more rooftop greenery and vertical greenery into the built environment contributes towards:

- (i) **Climate resilience**, as skyrise greenery mitigates the urban heat island effect by cooling the immediate surrounding environment, improving rainwater retention, reducing stormwater runoff and improving air quality by airborne pollutants.
- (ii) **Ecological resilience**, as skyrise greenery promotes naturalistic and biodiversity-attracting planting in the built environment to complement urban ecology of the area.
- (iii) **Social resilience**, as the green spaces act as communal spaced for gathering to connect people to nature while improving their well-being.

This year's edition seeks to feature a range of interesting skyrise greenery projects across the island and on different building typologies. We hope they will provide some valuable project insights and technical considerations in designing, installing and managing skyrise greenery projects.

For more information on skyrise greenery initiatives, head on to www.nparks.gov.sg/skyrisegreenery.



Skyrise Projects 2022

Note: Projects featured in this newsletter are contribution pieces by landscape designers and/or building owners. NParks does not endorse, recommend nor guarantee the quality of product or services offered.

Rooftop Greenery



Vertical Greenery



Mixed Developments & Office Buildings

- CapitaSpring 4



Commercial Buildings

- PARKROYAL COLLECTION Marina Bay 16



Residences & Community Institutions

- The Giving Garden @ Kim Tian 22
- Ang Mo Kio Court 24
- Eunos Polyclinic 26
- Jalan Daud 27

- Grab HQ 11

- Changi Business Park 12

- Bombardier Aerospace 14

- McDonald's @ Jurong Central Park 21

CapitaSpring

88 Market Street, Singapore 048948



Building owner: CapitaLand Development (CLD), CapitaLand Integrated Commercial Trust (CICT) and Mitsubishi Estate Co., Ltd

Building architect: Bjarke Ingels Group (BIG)

Renovation contractor: Dragages Singapore

Landscape Architects: COEN Design International

Tenant managing L51 Urban Farm: I-Group

Landscape implementer for L51 Urban Farm: Edible Garden City



CapitaSpring seeks to redefine and elevate workplace and living standards for its users as it adds an elegant new 280-metre-tall integrated development landmark to the Singapore skyline. With its multi-layered green spaces of more than 90,000 sq ft to cater to wide diversity of uses and creative lifestyle possibilities, CapitaSpring posits itself to not only be an attractive place for work, but also a vibrant place to live and play in.



CapitaSpring's abundant greenery helps to mitigate the urban heat island effect, while also enhancing workplace wellness for building occupants. Nestled between CapitaSpring's 29-storeys of premium Grade A office space and 8-storeys of Citadines Raffles Place Singapore, lies the Green Oasis at 100 metres above ground. The Green Oasis is an expansive spiraling botanical promenade that spans a total height of 35 metres from levels 17 to 20 and is home to over 38,000 plants adorning CapitaSpring's work-live-play amenities such as an amphitheatre, a yoga alcove, jungle gyms, ideation nests, work pods and a café.

1 Photo Source: CapitaLand

2 Photo Source: COEN

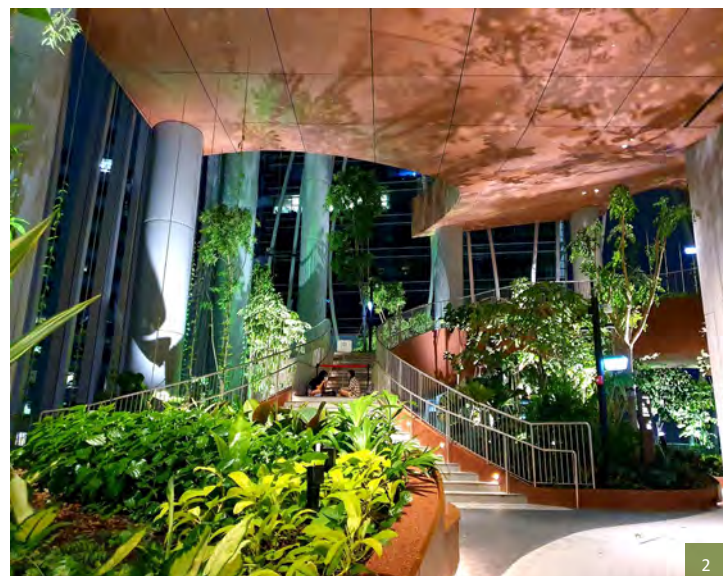
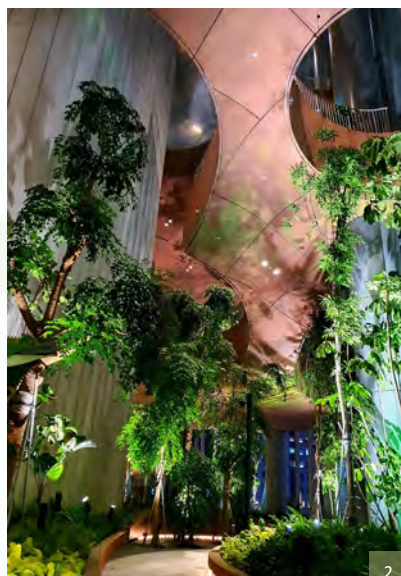


Interview with COEN

1. CapitaSpring is designed to be a green oasis in CBD area. What is the landscape design inspiration behind this project?

Captivated and inspired by the tropical rainforest and its wealth of flora and fauna adapted to life at various forest layers e.g., emergent and canopy layers, understory, and forest floor, we have designed the Green Oasis to allow users to get close to nature. Our softscape planting palette uses complementary tree and shrub species of different heights to replicate the forest layers and create visual interest.

This approach of creating biophilic green spaces within our office skyscraper albeit its location in the heart of the central business district is a nod to the recognition of what nature and greenery can do to lift our spirits. Such skyrise green spaces improve the overall climatic environment as they create microclimates that shape conditions needed for plant growth which coincides with optimal thermal comfort for users.



2. In your opinion, how does CapitaSpring help to strengthen City in Nature vision?

CapitaSpring is one of few publicly accessible green spaces in the CBD. We noticed that public's appreciation for greenery and its benefits rising during Covid-19 pandemic, with more people being active in green spaces and taking up gardening as a form of therapeutic release. In line with Singapore's transformation into a City in Nature, and Singapore Green Plan 2030, the importance of greenery is underscored with the goal of restoring nature into our urban city as we expect almost double the amount of skyrise greenery in our buildings and public infrastructure with the target of 200 hectares by year 2030.

Through our integrated development project at CapitaSpring, we wanted to satisfy public's growing demand for green spaces by creating a biophilic green environment that is conveniently accessible within the bustling business district. Our rooftop greenery helps to cool down the built environment, restore ecological biodiversity within the city and rejuvenate its users. Public can now take in fresh air outdoors at Green Oasis and L51 Urban Farm while enjoying panoramic views of Marina Bay and CBD, then work from anywhere within CapitaSpring.



3. What is unique about the sky gardens at CapitaSpring?

Our developer and designers are equally delighted that the principles that drive and guide the design of CapitaSpring's landscape are aligned with the objectives of City in Nature which is a key pillar of the SG Green Plan 2030.

The landscape gardens at the Ground Level, Podium, Green Oasis and Sky Garden are designed with biophilia and thermal comfort in mind to bring people closer to nature in their everyday lives, be it at work or play. The landscape gardens at CapitaSpring aims to restore nature into the built environment and add to the 7,800 hectares of green spaces that have already been achieved in Singapore.

The gardens carry a plethora of local plant species as careful planning was done to avoid just green washing the project. Local species planted in a naturalistic manner are used to encourage the establishment of local fauna. The creation of these urban yet naturalistic gardens aids in the strengthening of connectivity for fauna to move freely between green spaces, thereby extending the natural capital of both fauna and flora. We are delighted to observe bees and other pollinators finding their way to the Sky Garden sited at level 51 of the building. We could not ask for a better testimony than from these visitors.

Further, our gardens are designed for ease of maintenance and sustainability. CapitaSpring's landscape aims to restore nature within the urban environment so that users can soak in nature's presence and destress while at work or at home.

4. CapitaSpring is a high-rise building. What are your considerations when it comes to designing and implementing the sky gardens at CapitaSpring?

Our plants have been carefully selected for their ability to flourish in Singapore's tropical weather and humidity conditions and thrive at high levels. It is important for us to have an in-depth understanding of the tree species as the characteristics of each species will guide its application within the landscape. The selection of trees follows our basic rule of leaf architecture where the size and form of leaves are influenced by the altitude of their application. Trees exposed to stronger winds and sun rays typically have smaller and well spread leaves to reduce the wind drag-and- sail effect and vice versa for trees at the lower altitudes.

Trees that can tolerate the given sunlight intensity and hours of exposure are also selected for the different climatic facades of the project as the sun path guides the design on the placement of the trees and shrubs. Slow growing trees with aesthetic appeal and unique physical attributes are also selected and strategically positioned to form focal points and topics of interests. For trees that are placed closer to edge, we have selected species that are slower growing and have fine leaves to cope with the strong winds and high sun exposure.



6. Based on your experience, can you share key considerations when it comes to maintenance of trees at height?

For projects sited in high user density and in a high-rise application such as CapitaSpring, safety is at the top of our considerations. Trees planted in high-rise buildings need to be securely anchored and it is good practice to install permanent root ball anchoring systems for every tree. This will mitigate risks of uprooting during high winds.

Trees at CapitaSpring are permanently anchored at the rootball level and secondary tripod staking are also implemented during the establishment period. Trees that have a tendency for branch abscission are not selected due to concern of falling from height.

As the trees grow taller, it is important to continue to adjust the point of staking to support trees at their centre of gravity and provide adequate support. Yearly inspections by a certified arborist are also recommended for the development, as regular inspection and maintenance is a must for gardens in the sky to ensure safety.

The thinning of tree crowns during regular maintenance will aid in the reduction of the sail effect and the weight of the rains on the leaves. It is also important to checking on the staking which helps to support the trees to ensure that trees do not sway excessively or bend over.

5. How about the plant selection?

In the entire development, there are over 80,000 plants across more than 130 species in the whole of CapitaSpring, of which more than half are indigenous to Singapore. We purposefully introduced indigenous plant species to encourage the establishment of local fauna and increase biodiversity in the urban context.

Due to the unique environment created at the Green Oasis, the tree species *Heteropanax fragrans* (Fragrant Aralia) was introduced for their beautiful form as well as their ability to adapt to slightly lower sunlight availability. Mature trees of this species are planted to give an instant lushness to the tall volumes of the spiraling garden.

A plethora of shrubs unveils throughout different levels of CapitaSpring as they are selected and planted based on their suitability to adapt to the varying conditions and sunlight availability at the different levels. Amongst the backdrop of lush green, we planted several accent plants to form focal points and gently catch one's attention, such as *Fagraea ceilanica* (Perfume Flower Tree), *Suregada multiflora* (False Lime), *Medinilla magnifica* (Rose Grape) and *Tarenna fragrans* (River Tarenna) which we specially selected an indigenous species with both white and pale yellow fragrant inflorescence on the same plant.





Urban Farm at Level 51

Complementing the contemplative greenery in CapitaSpring is a rooftop urban farm at level 51. This urban farm was conceptualized and operated by 1-Group for their farm-to-table concept to help reduce the restaurant's carbon footprint in sourcing herbs and vegetables. The urban farm seeks to evoke public's sense of exploration and curiosity in plants with its five thematic gardens, namely the Singapore Food Heritage Garden, The Wellness Garden, The Mediterranean Potager Garden, The Australian Native Garden and The Japanese Potager Garden.

Interview with 1-Group & Edible Garden City

1. What is unique about the edible garden or urban farm that you are managing at Level 51 of CapitaSpring and how does this complement the F&B concepts there?

Managed by 1-Group, 1-Arden is an integrated F&B lifestyle destination where we wanted to put forth a place to educate the public on sustainability through carefully curated edibles and provide a whole new understanding of the many layers on biodiversity and its importance to ecological relevance. This forms our overall concept of "Sustainability on Show".

With 130 varieties of plants and over 3300 plants consisting of diverse and unique mix of edible flowers and fruit trees at Level 51's urban farm, we use farm-to-plate dining concepts to raise awareness on how sustainable and responsible farming can be brought to the dining table in a fun and engaging manner. Chefs and mixologists are empowered to become advocates and bring their creativity and knowledge into dishes and cocktails as they take specially selected ingredients from the food forest to create a botanical feast for the senses.



2. What is the inspiration behind the design concept of Level 51's rooftop urban farm?

We were inspired by the food forest planting method which makes good use of space with efficient layering of foodscapes, utilizing the ground, the underground and the 'vertical layers' of the trees. This was how our concept of the urban farm was born as we seek to present a new urban agriculture with lush and aesthetically pleasing edible greenery at the rooftop of CapitaSpring.

We optimised every area, both vertically and horizontally, of our garden space to ensure maximum yield. Layer 1 is the rhizosphere layer and consists of root vegetables like Ginger. Layer 2 is the soil surface layer and consists of ground cover like Spearmint. Layer 3 is the herbaceous layer and consists of herbs like Lemon Balm. Layer 4 is the shrub layer and consists of fruiting vegetables like Roselle. Layer 5 are small fruit trees like Guava. Layer 6 is the canopy layer and consists of trees like Moringa. Layer 7 is the vertical layer and consists of climbing plants like cucumbers.

These layering of plants helps to establish cooling microclimates and encourage growth of ecological biodiversity and biomass, creating a more resilient ecosystem as the plants attract birds and beneficial insects.



3. What goes behind the plant selection process for the urban farm?

To strengthen the farm-to-plate concepts offered by 1-Arden, we curated thematic gardens, such as Tropical Wellness Garden, Singapore Food Heritage Garden and Potager Kitchen Garden. Our gardens are planted using the food forest methodology mentioned earlier.

The Tropical Wellness Garden showcases herbs of medicinal qualities with unique textures and aromas. There is a mix of well-known herb species such as lemongrass and mints, and lesser-known tropical medicinal herbs such as sabah snake grass and oyster plant. Located at the entrance, visitors can feel the immediate healing benefits from the Tropical Wellness Garden when they enter the urban farm. We collaborated with STB in June 2022 for their Wellness Festival event where the community is invited to this garden to promote their well-being.



The Singapore Food Heritage Garden focuses on a lush mix of local species that have an element of heritage. We feel that the preservation of ingredient knowledge from kampong days and passing down through generations, educates people on the importance of an ecologically balanced and sustainable world for future generations. Hence, we wanted to create an educational garden and include plant varieties which are rare, threatened and/or possess importance in conservation, heritage, and ecological aspects. An example of a local heritage plant would be the *Breynia androgyna* (Sayur Manis) which was commonly stir-fried or boiled in soup during kampong days.

The Potager Kitchen Garden is a more conventional method of 'farming' with clusters of the same crop planted near one another. Our planting method lightly follows the structure of the food forests while creating cohesive yet diverse plots in an aesthetic manner. This garden follows a tighter schedule of harvesting, clearing of beds and replanting. This garden features exciting produce of common plants such as *Piper sarmentosum* (Wild Pepper), and uncommon fruit and vegetables such as *Cyperus esculentus* (Tiger Nut). To complement 1-Arden's Japanese and Australian cuisines, we planted a good mix of Southeast Asian and Japanese crops, such as *Peperomia pellucida* (Shiny Bush) and *Brassica juncea* 'Wasabina' (Wasabina Mustard).



4. Could you share with us on how the urban farm works closely with the F&B restaurants to introduce interesting plants to the public?

Sustainability is a key notion at 1-Arden. For example, our farm-to-plate coastal Australian restaurant 'Kaarla' at Level 51 sells responsibly sourced Australian seafood, meats and agriculture. Complementing this, Level 51's urban farm will supply unique Australian native plant varieties to the restaurant. In partnership with the Australian High Commission, we wanted to give proper cultural recognition to the Aboriginal Australians, i.e., the nation's oldest population. This includes planting 'salty' varieties that will pair well with seafood. For the first time in Singapore, visitors will be delighted with the curious and fragrant flavours and aromas of varieties such as lemon myrtle, warrigal greens, Australian mint, sea blite, geraldton wax and more.

In the curation and implementation of Level 51's urban farm, both 1-Group and Edible Garden City ("EGC") share keenness to deepen our knowledge of the produces and we communicate frequently with each other to deliver the best experience to our visitors and F&B patrons. EGC's farmers will observe plants at different stages outside of what they are commonly used for and make their recommendation to 1-Group's Chefs John and Lam Lee. For instance, the ripe berry fruit of the curry leaf plant has a blueberry texture and comforting curry leaf aroma. As such, when produce is at its peak ripeness, Chef John pickles them using traditional methods.

The Chefs share their dream list of plants and tastes with EGC's farmers who will then experiment to attain their wishes. One of our successful experiments is the Tiger Nut. It has a ground nut that has a texture of water chestnut and tastes similar to almond milk. Our Chefs also save seed or cuttings from imported produce for growing trials in the garden.

The collaboration between chefs and farmers helps to maximise the culinary value of every single plant. Together, we can discover new flavours and textures from familiar plants and push boundaries of plants that are not commonly grown here.



5. Any challenges to maintaining an urban edible farm on the 51st storey?

Our urban edible farm is completely exposed to weather elements and thus, we must learn to adapt with it. Due to the high altitude of level 51, we experience intense weather elements not commonly experienced at a lower altitude. Strong and gusty wind may damage the stems and stalks of tender vegetables or shrubs, or may cause them to collapse. We have learned to adapt to these situations, and it's not uncommon for us to add anchors to these plants. Conversely, the same strong winds also benefit the plants by reducing atmospheric humidity and increasing the transpiration rates, which helps to accelerate the growth of some varieties of leafy vegetables.

1 Photo Source: CapitaLand

2 Photo Source: COEN



Grab HQ

3 Media Cl, Singapore 138498



1



1



1

Building owner: Grab

Landscape Implementer: Nature Landscapes

Located inside One North Business Park, the new Grab HQ Singapore embraces their 'green' branding by incorporating biophilic design and green sustainability features in its new office building. Residents and visitors will be welcomed by breath taking vertical greenery and mid-level sky terraces when strolling into Grab HQ's communal grounds. The newly installed landscaped green wall covers a total area of 252 sqm with its open and long walkway of plants adorning its office building facade.

1. How does the green wall support Grab's green environmental objectives?

Grab sets out to protect the environment for future generations with its GrabForGood initiative and positively impacting three identified core groups, namely People, Partners and the Planet. Aligned with its mission to reduce carbon footprint, Grab installed a continuous vertical green wall at the façade of its HQ. The plants convert carbon dioxide emitted from human activities to oxygen, filter toxins in the air and improve air quality.

2. What are the plant species that you have planted to achieve its desired effect of designing an image on the green wall?

In the design of Grab HQ's green wall, we used clear and distinct hues of foliage plants to accentuate gradient highlights. We considered varying light levels that are naturally available throughout the day in the selection of suitable plants for the walls. The plants that we selected are low maintenance, can survive well with indirect sunlight and grow fast enough for good green wall coverage. We purposefully kept the variety of plant species simple to two varieties, i.e., *Philodendron hederaceum* var. *hederaceum* and *Philodendron hederaceum* 'gold' (Heartleaf Philodendron), to maintain uniformity in the green wall design and create a clean look.

1 Photo Source: Nature Landscape



Changi Business Park

8 Changi Business Park Avenue 1, Singapore 486066



Building owner: ESR REIT

Landscape Implementer: Vertical Green

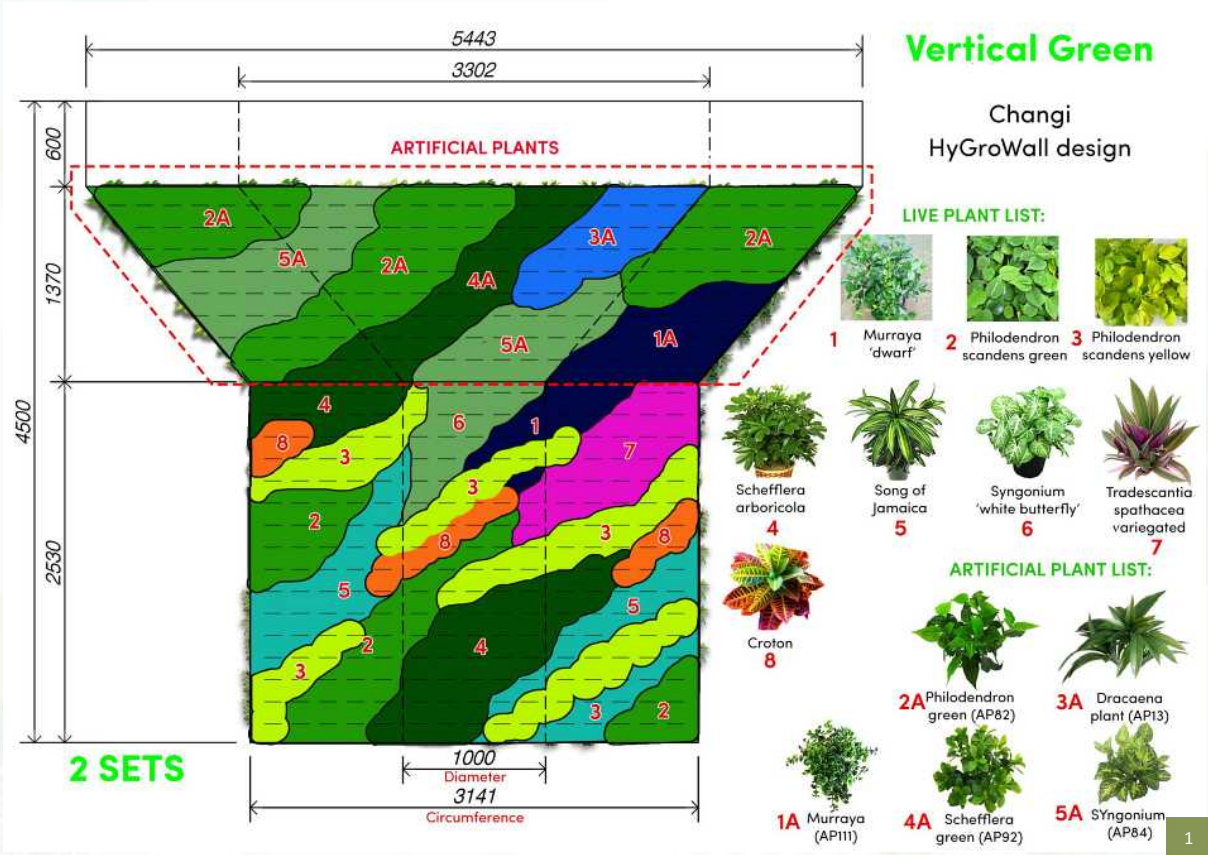
The majestic tree-like vertical green walls standing 4.5m tall at Changi Business Park provides a green sanctuary for building occupants and visitors. The vertical greenery installation offer a therapeutic green environment in the otherwise harsh built environment in a space-saving, vertical manner. Purposefully located in the open space between two buildings, these vertical green structures symbolically connect the buildings and increase the overall area's aesthetic value, while doubling as shady seating areas, acting as green respites that lower the ambient temperature at the naturally ventilated foyer.

1. What is your greatest challenge while designing and/or installing vertical greenery?

Our vertical greenery were designed to have a ledge around the bottom of each tree for seating purposes and therefore we had to make sure that the widths of the green walls were kept sleek without too much protrusion. To achieve that, the control panel for water irrigation was located inside each tree-like structure, with a maintenance door located at the bottom of the trees for easy access, thus keeping the aesthetics of the trees' exterior immaculate. We also installed growth lights at the bottom, shining upwards to promote plant growth and minimise visual disturbances to people sitting at the ledges.

2. What are your design considerations behind the planting palette of the vertical green structures?

We wanted the vertical greenery to be visually congruous with the surrounding landscaping of the space, while still acting as eye-catching focal centerpieces. Hence, we decided to create spiral patterns to increase its visual appeal. Using plant species such as Crotons and *Tradescantia spathacea* 'Vittata' (Variegated Boat Lily), we achieved pops of colour to add vibrancy to the design. Also, to ensure the sustainability of the wall, the plant species chosen are hardy and easy to maintain, including *Philodendron*, *Heptapleurum arboricola*, *Syngonium* and *Dracaena reflexa* (Song of Jamaica).



3. What is the feedback you have received by building occupants and visitors?

Installation was smooth sailing for this project as we didn't face much technical issue. We observed enthusiastic reactions from surrounding passers-by and we are honoured to have played a part in bringing the clients' vision for their space to life.

1 Photo Source: Vertical Green

Bombardier Aerospace

10 Seletar Aerospace Heights, Aerospace Park, Singapore 797546



Building owner: Bombardier Aerospace

Landscape Implementer: Greenology

With a heritage dating back to its first aerospace venture in 1986, Bombardier has at its core a forward looking, innovative spirit that is embodied by its people and the aircraft it has proudly manufactured, sold and supported with decades of expertise. Bombardier wanted to create a green wall that reflects its company mission to bridge distances and bring people together with business aircrafts.

With this brief, Greenology created a green wall art with strips and cables creatively designed to symbolize Bombardier’s mission of connecting people and places in a green way with lower carbon prints. The undulating profile of the base provides an artistic look and feel to the green wall, while the various strips and cables sprawling across the walls act as bridges for the plants to traverse and establish themselves, creating a dynamic spatial experience.



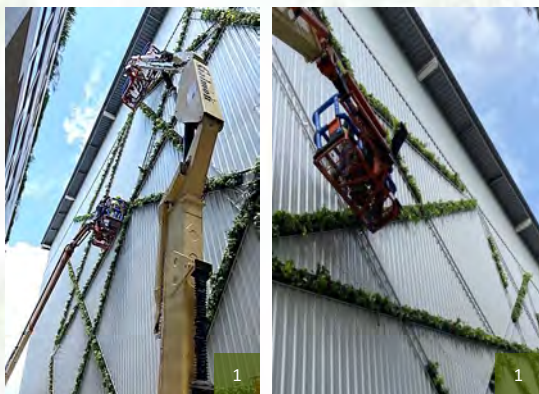
1. What are your considerations of the design and implementation of the green wall?

We adopted a minimalistic approach for the design of this green wall as sometimes, less conveys a stronger messaging. Instead of having a wall full of plants, we needed the staff to notice the stark difference of the grey steel wall against the vertical greenery for them to realize how nature, even in singular linear lines makes a difference. These vertical green wall lines also serve as daily reminder to all staff of Bombardier’s mission and vision to connect the world with sustainable aviation solutions.



2. What is your greatest challenge when implementing the green wall design?

For green walls to be sustainable and maintainable, they must be planned and designed properly right from the beginning during conceptualization stage. It was an engineering challenge for us to install automated irrigation and fertigation system on such a uniquely designed green wall.

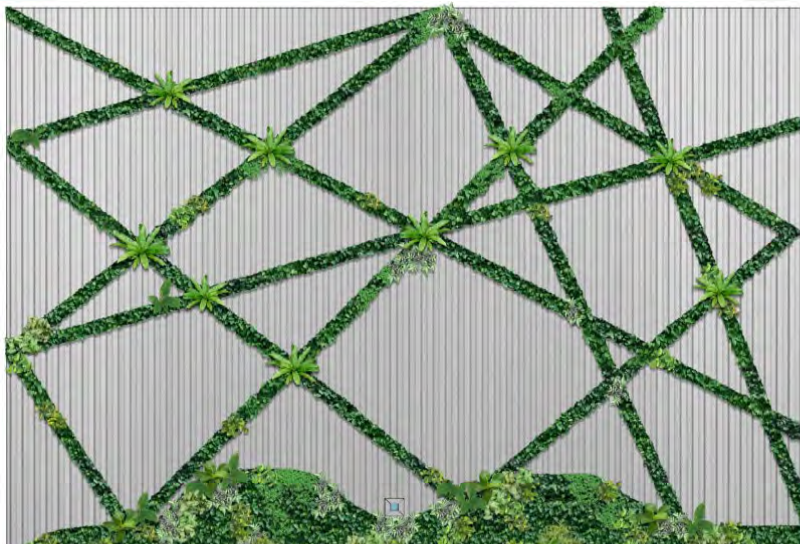


(Continued next page)

For plants to sustain on a green wall, it is crucial for them to receive sufficient water and nutrients all year round and hence, we had to carefully engineer the automated irrigation and fertigation system. Through brainstorming, testing of ideas and past experiences, we developed in-house solutions to install green wall with irrigation and fertigation system. Using various work-from-height machineries, our team created this masterpiece in less than a week. This was done with careful planning and scheduling of works to ensure that the green installation will be completed smoothly and safely.

3. **How did you select suitable plant species for this customized green wall?**

Plants were carefully chosen based on their ability to thrive on the engineered system, survive in outdoor weather conditions and require minimal maintenance, such as *Chlorophytum comosum* (Spider Plant), *Procris repens* (Trailing Watermelon Begonia), *Philodendron* spp., *Pilea* spp. and *Syngonium podophyllum*. Accent plants such as *Asplenium nidus* (Bird's Nest Fern) were used to create a 3-D effect to punctuate at connecting nexus.

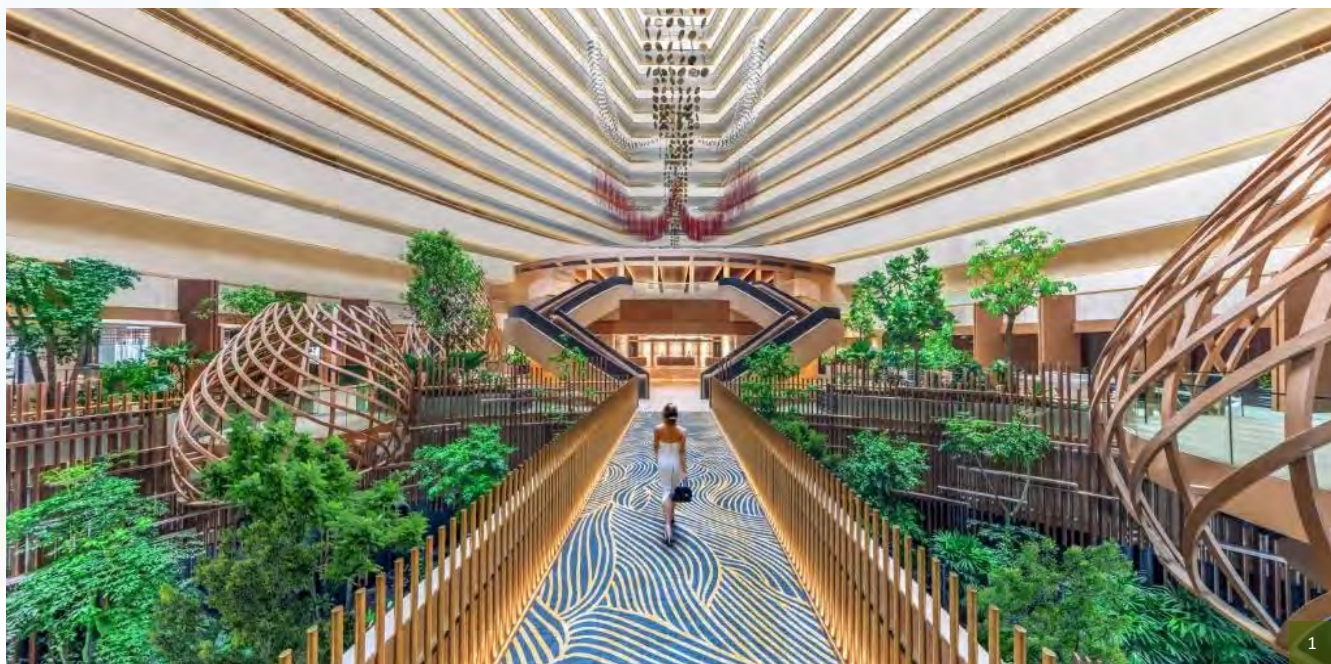


1

1 Photo Source: Greenology

PARKROYAL COLLECTION Marina Bay, Singapore

6 Raffles Boulevard, Singapore 039594



Building owner: Pan Pacific Hotels Group, UOL Group Limited and Singapore Land Group Limited

Renovation contractor: Tg Décor & Cheng Meng Furniture Co.

Building architect: Donovan Soon, FDAT Architects LLP

Landscape Architects: Ramboll Studio Dreiseitl

Landscape contractor for L4 Urban Farm: Edible Garden City

The Park Royal Collection Marina Bay is envisaged as a tropical Garden-in-a-Hotel incorporating a myriad of sustainable building design concept, such as biophilic design, liveability, and ecologically responsible design.

At the heart of the hotel lies a green atrium featuring a tropical forest thriving across multiple floors, adding spatial quality to rejuvenate visitors. More than 40 species of trees and around 25 different species of shrubs and groundcovers have been planted at the atrium, contributing to a tranquil and improved indoor space quality by providing fresh air and reduced ambient noise. The voluminous height of the atrium with natural skylight has enabled a spatial design that gives a perceptual illusion of an external garden space. Guests of the hotel can enjoy the unique experience of mingling at stylish contemporary birds' nest-like architectural pavilions amidst lush foliage greenery flowing down the tiered planters.

1 Photo Source: PARKROYAL COLLECTION Marina Bay, Singapore

2 Photo Source: Ramboll Studio Dreiseitl

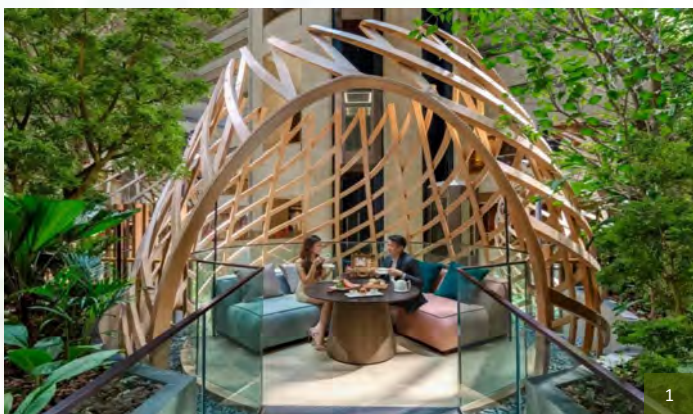
3 Photo Source: Edible Garden City

Interview with Ramboll

1. How does the indoor landscaping complement Singapore's 'City in Nature' vision?

Ramboll is committed to create a liveable urban environment and bring people closer to nature. This was translated to the vision we had for PARKROYAL COLLECTION Marina Bay, Singapore as we transformed the building into a lush, tropical "Garden-in-a-Hotel" which further strengthens the eco-conscious branding of PARKROYAL COLLECTION Hotels and Resorts.

Inspired by the 'City in Nature' vision, the hotel brings flora (fauna refers to wildlife!) closer to the community as we enhance visitors' connection to natural environment with the atrium acting as the green heart of the hotel. The landscaping at the atrium mimics a thriving tropical forest with three-dimensional planting of groundcovers, shrubs, trees and trailing plants acting as the different layers of the forest. Trees and shrubs with diverse foliage shapes, textures and green tones play a crucial part in adding localised accents to enhance the naturalistic look and feel of the gardens.

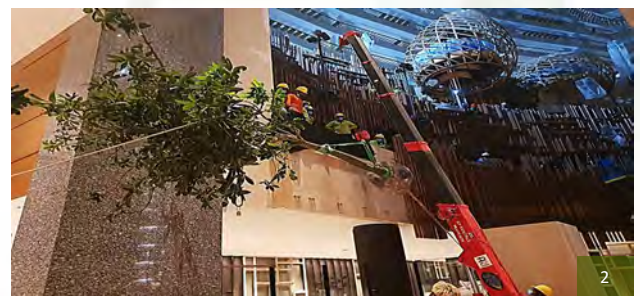


2. Bearing in mind that the planting areas are indoors, how did you choose suitable plant species for the hotel?

Light, temperature, indoor climate, and soil depth were all considerations that had to be accounted when curating the plants for the project. In collaboration with arborists, species selection was made with the premises in mind, to ensure that plants would be able to adapt and thrive in indoor conditions. We carefully selected tree and shrub species to suit indoor conditions and ensure that the trees are acclimatised to thrive in indoor conditions a couple of months prior to planting.

3. What would you say is the greatest challenge when it comes to the implementation/planting of the trees in an indoor built environment? How did you overcome it?

The coordination of landscaping works within the overall renovation works was one of the biggest challenges due to the tight timeline of hotel operations. As our trees can weigh up to 400kg, we had to brainstorm on ways to hoist trees indoors. Eventually, the stakeholders and contractors had to employ creative indoor solution to supply and hoist the towering trees by using spider crane with forklift. However, the use of heavy machinery raises concerns on whether loading capacity of existing planters and slabs can withstand the weight. We overcame this challenge by using lightweight materials and distributing the loads according to the plant palette, i.e., deep soil depths of planters are only for where trees are located while shallower soil depths are used for the rest of the shrubs and ground covers.



4. How do you manage the maintenance regime of the trees such that it minimises disturbances to hotel guests, and yet ensure that the landscapes are well maintained for safety and aesthetic reasons?

Maintenance regimes are scheduled to be only an hour-long daily at periods where the hotel experiences low traffic. Since construction and other renovation works were ongoing, the trees were permanently covered with dust and had to be cleaned often. However, because the plants at the hotel are indoors, cleaning them cannot be done with chemicals or pesticides – instead, they must be treated by wiping the foliage with natural oil.

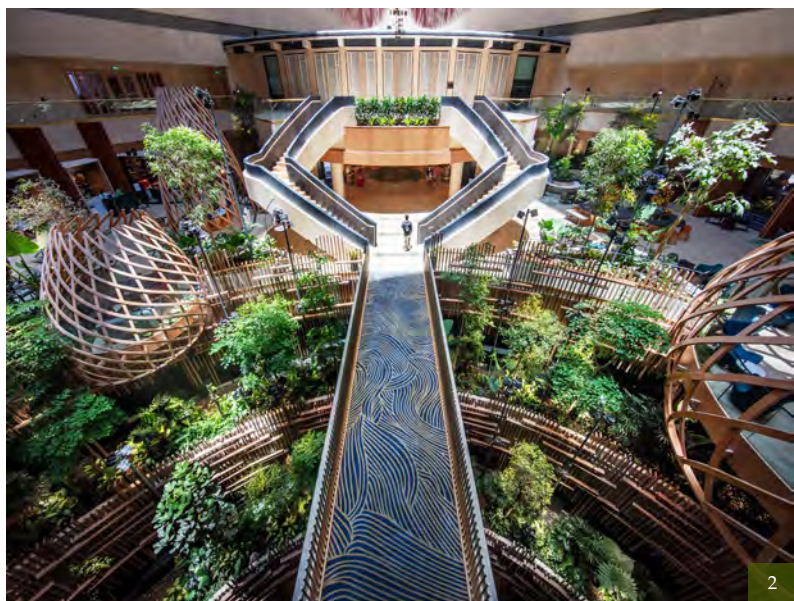


5. How are the plants and trees faring after installation?

Fortunately, not a lot of plant replacements had to be done. We had to manage and proactively coordinate while installing living green features amongst ongoing renovation project works. It was a learning curve for all of us, from supply, acclimatisation, light availability, to building a conducive indoor climate for the plants. For example, we observed that some species tend to grow better indoors than others. This translates to useful learning experience for us and enabled us to keep records of which trees thrive best indoors. We can then focus on specific greenery palette for future projects to ensure better success rate.



1



2

6. Has the Atrium Greenery helped to boost and drive-up hotel business? What are some of notable feedback you have received from guests and staff?

PARKROYAL COLLECTION Marina Bay, Singapore recently clinched the 2021 KBDA Travel: Urban Hotel – Interior Design Award and Ramboll is incredibly proud to play a part in this field of hospitality that is paving the way for a greener future for us all as we continue to look to sustainable innovation in the future.

The hotel management has shared many good reviews on our greenery, sustainability efforts and positive coverage from media sites. Here are some of the feedback received:

“The interiors are pleasing and comfortable. The bubble lift further makes it even more lovely with the view of the atrium when travelling between the ground floors and your room.” – Seeingtheworldinsteps

“Beautiful touches of light wood from the stairway to the bird-cage like pavilions at the Portman’s Bar. Lush greenery aplenty as guests walk across the Atrium Skybridge, which is the most Instagrammable spot in the hotel.” – therantingpanda

1 Photo Source: PARKROYAL COLLECTION Marina Bay, Singapore

2 Photo Source: Ramboll Studio Drieseitl

3 Photo Source: Edible Garden City

PARKROYAL COLLECTION Marina Bay, Singapore's Urban Farm

The hotel's brand-new restaurant at Level 4, Peppermint, provides farm-to-table cuisine that includes plant-based options and the use of sustainable and locally sourced ingredients. Visitors can step out to the terrace outside the restaurant and discover the hotel's very own Urban Farm, where more than 60 varieties of herbs, edible flowers, vegetables and fruit are grown and used as salads, garnishes, aromatics, and ingredients for the dishes, as well as beverages, such as infused tea and water.



Interview with Edible Garden City

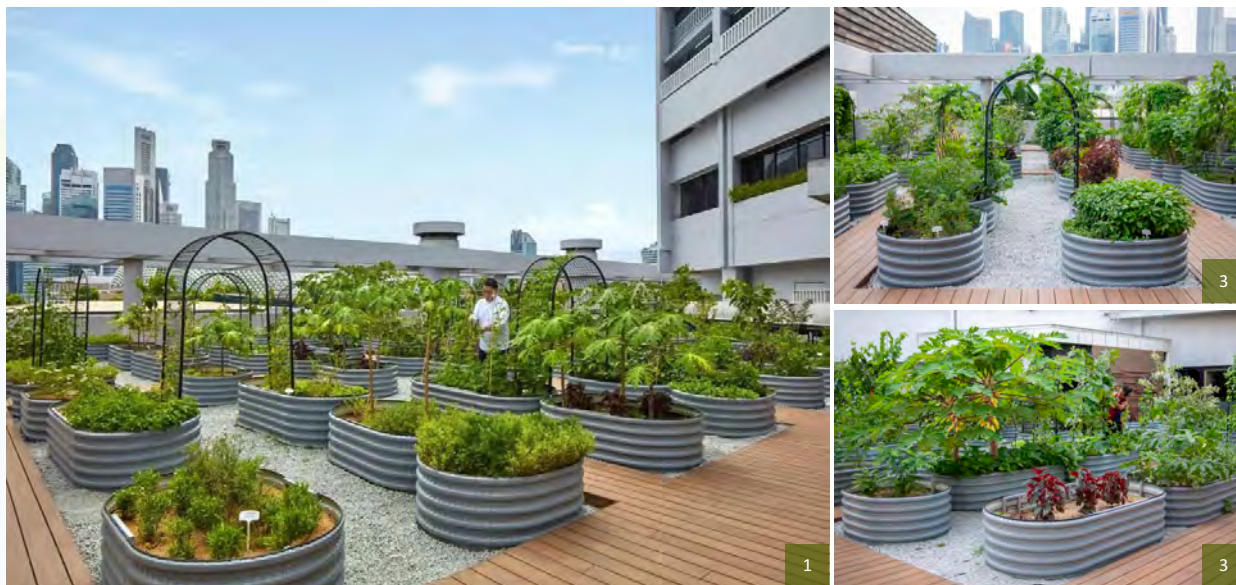
1. What are the objectives of the Urban Farm at PARKROYAL COLLECTION Marina Bay, Singapore?

The Urban Farm here at PARKROYAL COLLECTION Marina Bay, Singapore is designed to be an inviting green space for guests to meander and explore, and where beautiful produce is grown for the hotel's restaurants, bar, and spa.

We wanted guests and diners to experience hospitality and dining in a more eco-conscious manner. Visitors are immediately greeted by the 150 sqm Urban Farm, with its grand arches and neat rows of lush, colourful edible produce when they step out of the restaurant onto the outdoor deck. The arches at the Urban Farm are perfect spots for guests to take Instagrammable photos.

The Urban Farm bolsters the hotel's food supply resilience by growing produce locally, cutting carbon emissions and improving environmental sustainability through natural farming methods. The farm provides fresh ingredients harvested daily, which reduces storage costs, eliminates preservatives, and enables the hotel to innovate with plant-based recipes as an alternative to meat dishes. This helps guests to tap into the benefits of healthier living through green diets and reduce the demand for meat farming, a water- and carbon intensive process.

1 Photo Source: PARKROYAL COLLECTION Marina Bay, Singapore
 2 Photo Source: Ramboll Studio Drieseitl
 3 Photo Source: Edible Garden City



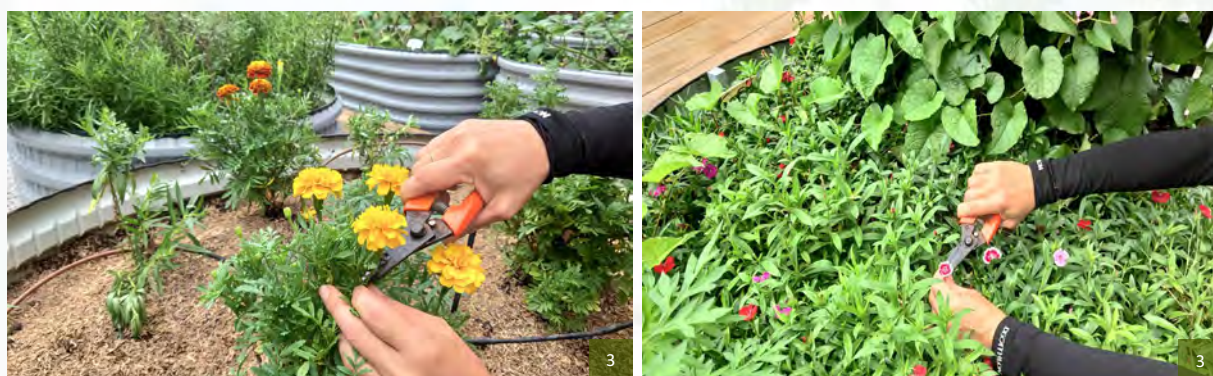
2. How does the Urban Farm contribute to Singapore’s ‘City in Nature’ vision?

The Urban Farm was revamped from an ornamental garden and with more edibles in the garden now, the farm plays a pivotal role in introducing more biodiversity into the surrounding urban landscape where it is located, strengthening the ‘City in Nature’ vision. Our Urban Farm consists of more than 60 corrugated metal planters, home to more than 60 varieties of edible plants, ranging from herbs, fruits, edible flowers, and vegetables. As fruits like golden papayas, red guavas and passionfruit emerge, we observed birds and pollinators start using the garden as their playground.

Sustainability is key to maintaining a good edible garden and nourishing the soil is one of the most underrated components of successful farming. The Urban Farm composts the organic materials from its plants and coffee grounds from the hotel. The compost is then fed back to the soil to nourish the plants.

3. What would you say is a key factor that contributed to the success of the hotel’s Urban Farm?

Teamwork is key to the success of the hotel’s Urban Farm. Our team learned how to collaborate well with the hotel’s culinary team to ensure that the design and implementation of the Urban Farm is sufficiently efficient to supply ingredients for ongoing F&B operations and fulfil environmental sustainability objectives. Our Urban Farm supplies 20% of the hotel’s needs, for example, farm-to-table food offerings at Peppermint and Peach Blossoms restaurants, signature cocktails designed based on the Urban Farm’s produce at Portman’s Bar and refreshing beverages with freshly plucked leaves from the Urban Farm at St. Gregory. This partnership with the chefs & hospitality staff at the hotel is a crucial contribution to the sustainability of the Urban Farm. The collective effort and constant feedback help the Urban Farm to evolve, stay on top of things and remain productive.



1 Photo Source: PARKROYAL COLLECTION Marina Bay, Singapore

3 Photo Source: Edible Garden City

McDonald's @ Jurong Central Park

291 Boon Lay Way, Singapore 649849



McDonald's Jurong Central Park transformed their blank concrete pillars within their restaurant into living works of art using vertical gardens to soften its urban environment.

1. Why did you install vertical green walls on your pillars, instead of opting for regular shaped flat green walls? ‘

McDonald's Jurong Central Park is one of our most beautiful and recognizable park restaurants. The restaurant drew inspiration from the surrounding greenery in the park and literally brought nature even closer to our customers by wrapping existing columns with greenery. This helps us to ensure that our outdoor dining area remain open and porous for customers to still enjoy the park's natural greenery views.

2. What is McDonald's consideration in the selection of plant species for the green walls on pillars?

To ensure the longevity and sustainability of the plants installed on our vertical gardens, we curated our planting palette to include shade loving but foliage rich plants such as *Philodendron hederaceum* (Heartleaf Philodendron), *Chlorophytum comosum* cultivars (Spider Plant), *Heptapleurum arboricola*, *Dracaena reflexa* (Song of India), *Aglaonema 'Red Master'*, *Syngonium 'White Butterfly'* and *Tradescantia spathacea* (Dwarf Boat Lily).



Philodendron scandens green

Chlorophytum comosum

Schefflera green

Song of jamaica

Aglaonema red

Syngonium 'white butterfly'

Tradescantia spathacea

3. Could you share with us the responses you have received from staff and public regarding the new installation?

Customers and staff enjoy the green concept and unique atmosphere when they are at McDonald's Jurong Central Park. Park visitors comment that they enjoy having their McDonald's favorites while dining in the outdoor seating area where the park's beautiful greenery is seamlessly blended with the restaurant's design. Customers appreciate that the vertical plants are a distinctive touch to the restaurant's park concept.

The Giving Garden @ Kim Tian

Block 119A Kim Tian Road, Singapore 169263

'The Giving Garden @ Kim Tian West' is a first-of-its-kind community garden, where Tanjong Pagar Town Council grows fresh produces at The Giving Garden to harvest and distribute them to residents in the surrounding vicinity.

The 1,020m² rooftop garden provides a picturesque view to residents living at the blocks along Kim Tian West and Jalan Membina with more than 45 species of plants and at least 10 different types of vegetables. The rooftop greenery also plays an integral role to cool the previous concretised car park roof deck making the surrounding environment more pleasant and created a vibrant communal spaces for its residents to enjoy.



Building owner: HDB

Area managed by: Tanjong Pagar Town Council

Landscape implementer: Garden Works

1. What is the design concept and inspiration behind the Giving Garden?

The Giving Garden is a collaboration between the Tanjong Pagar-Tiong Bahru Citizens' Consultative Committee, Kim Tian West Residents' Committee, the National Parks Board and the Tanjong Pagar Town Council. Ms Indranee Rajah, Minister in the Prime Minister's Office and Adviser to Tanjong Pagar GRC Grassroots Organisations, envisioned a holistic and meaningful space, where the community can grow vegetables and fruits for their consumption, learn about urban farming, supplement food security, bond the community and provide a therapeutic green space for users to enhance their health and well-being. The garden was named 'Giving Garden', as all harvested edible plants are distributed to the residents. The strong engagement of a thriving community is the heart of The Giving Garden.

2. What are some interesting design considerations of 'The Giving Garden' that TPTC would like to highlight?

First, we raised the height of existing Prefabricated Extensive Green (PEG) trays by 200mm, so that our PEG trays which initially could only house groundcover will now have more soil depth to support the growth of ornamental shrubs and vegetables. This helps to add more colours and lushness to our garden. *(Continued next page)*

With more variety of plants grown, The Giving Garden acts as a good physical learning platform for children to understand and appreciate plants grown in edible garden.

Next, we wanted to create a vibrant yet soothing setting to cater to the different demographics living in Kim Tian and thus, painted our planters with soothing colours like lime green, lemon custard and pink colours. Our planters look like they ‘come to life’ under the sunlight. We also made considerations to ease the loading capacity of our rooftop garden and used lightweight blocks for our planters.

TOP & MIDDLE PHOTOS: Community gardeners maintaining The Giving Garden.

BOTTOM PHOTO: Vegetables fruiting in the rooftop garden.



3. ‘The Giving Garden’ focuses on edibles and biodiversity-attracting plants. Could you elaborate more on your plant choice?

Our built-up planters and peg trays have been planted with a variety of vegetables and woody edible plants such as *Brassica oleracea* (Kai Lan), *Brassica rapa* (Xiao Bai Cai), *Ipomoea aquatica* (Kangkong), *Spinacia oleracea* (Spinach), *Lactuca sativa* (Lettuce), *Brassica juncea* (Chinese Mustard), *Brassica rapa* (Chye Xin), *Abelmoschus esculentus* (Lady’s Finger), *Solanum melongena* (Brinjal), *Cucumis sativus* (Cucumber), *Vigna unguiculata* (Long Bean) and *Passiflora edulis* (Passion Fruit). We have had considerable success with some of the plant species, for example the brinjals have been fruiting continuously and we harvested about 50 fruits on each plant within 3 months.

We are glad to observe our flowering plants such as *Stachytarpheta indica* (Snakeweed), *Lantana camara* (Spanish Berry), *Costus* spp., *Ruellia* spp., *Hibiscus* spp. and *Tecoma* spp. attracting butterflies, bees and sunbirds for pollination. This helps to benefit both the edibles and ornamental plants in the garden.

4. How are the residents taking to the new Rooftop Garden?

Our residents are very pleased with the Giving Garden. We frequently see residents enjoying leisurely strolls around the garden, watching the butterflies, bees and birds feeding on the flowering plants. The Giving Garden also ignited gardening interest in some of them as they enquire with us on tips to grow edible plants.

1 Photo Source: Tanjong Pagar Town Council

2 Photo Source: NParks (Jacqueline Chua)



Ang Mo Kio Court

2 Ang Mo Kio Street 23, Singapore 569341



Building owner: HDB

Area managed by: Ang Mo Kio Town Council

Landscape Architect: Surbana One

Landscape Implementer: Nature Landscapes

Conveniently located at a walkable distance from Mayflower MRT and Ang Mo Kio MRT station, Ang Mo Kio Court is positioned as a green and central urban spine that offers lush green spaces in its precinct. The rooftop boasts a total landscape area of 11,801 sqm with more than 37,717 trees and shrubs planted.

At the heart of Ang Mo Kio Court is a high-rise courtyard of approximately 1,258 sqm in size. Residents can get to enjoy a wide range of recreational facilities with pockets of communal spaces and connect with each other amidst the lush greenery. Its landscape design encompasses the sky terrace in a green enclave, complementing its hardscape. Even from a distance, verdant green landscape is clearly visible.

1. The rooftop garden that you have implemented and planted is so lush. Tell us more about the concept for the rooftop garden and the plant selection process.

The rooftop garden was conceptualized as an elevated park in a heartland. We populated the garden with plant species such as *Osmoxylon lineare* (Yellow Aralia) that are more suited for urban environments and helps to accentuate the communal grounds with a tropical flare. Our landscape design is centered around choosing tree species with leaves of different sizes, texture, colours and shape. This will help to create layering effect within the garden. To encourage community bonding through gardening, a small community garden is created in the middle of Ang Mo Kio Court as the community is encouraged to visit the garden after their work hours and on weekends for therapeutic gardening activities.



2. Given that the rooftop garden is located at a residential area with high footfall, could you advise on the maintenance regime and impart some tips for maintaining trees on rooftop gardens?

For safety reasons, the trees on rooftop gardens need to be regularly pruned to keep to a maintainable height. Crown thinning should be done regularly to keep the tree form and size small. This is to ensure less wind resistance and minimize impact of tree fall from height.

We also pay closer attention to trees planted at the edge of the planters and locate them at a safe distance from the roof garden edge.



3. How does this rooftop garden boost precinct green provision for residents and boost their well-being?

Rooftop gardens reduce urban heat island effect, improve air quality, decrease carbon emissions, boost the well-being of users, and create a habitat for biodiversity. Therefore, having more green rooftop spaces in proximity of residences brings about many benefits to our residents.

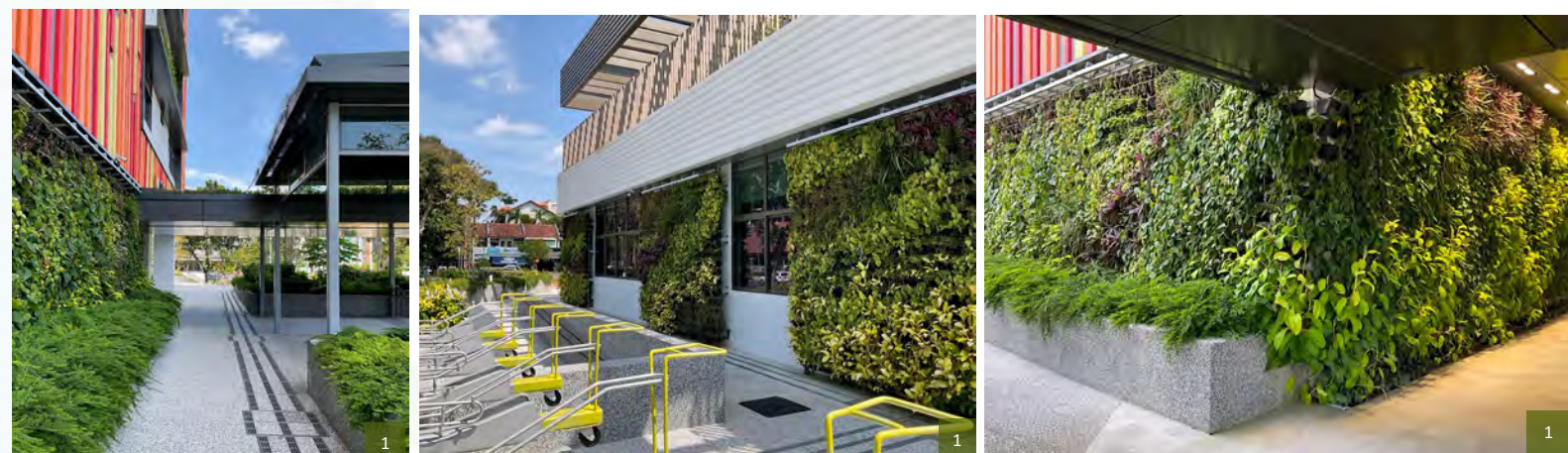
4. Could you elaborate on the eco-friendly features of your rooftop garden?

Ang Mo Kio Court has several eco-friendly features built into the flats such as motion-sensor controlled lighting, regenerative lifts, and eco-pedestals in bathrooms. In line with being eco-friendly, we installed irrigation system at the rooftop garden with two water-conservation features. Firstly, our drip irrigation pipeline helps to direct water to planted areas and minimize water leaching at unnecessary areas. Secondly, our rain sensors will automatically stop irrigation during and after raining when moisture is detected inside the sensors.



Eunos Polyclinic

1 Chin Cheng Avenue, Singapore 429400



Building owner: SingHealth Polyclinics

Landscape Implementer: COEN

Located 10-minute walk from Eunos MRT station, residents staying at Eunos can look forward to a new modern-looking clinic with a warm and inviting green wall façade. The verdant green walls along the ground floor meld the outdoor greens with interior corridors and waiting spaces as they provide therapeutic biophilic effect for clinic's patients and passing traffic. The newly installed green walls of 210m² help to reduce the heat gain from the environment, reduce the microclimate temperature of the adjacent spaces and provide a more soothing environment for its users.

1. It is a tricky technical implementation to create a seamless green wall at sharp corners. Could you impart some tips on how you did it?

The selection of suitable green wall system is crucial when it comes to detailing the interface between plants and architecture. For Eunos Polyclinic project, we installed tray modular system with corner or edge pieces to cater to the architecture design challenge of adjacent walls. We also considered the low light availability at the corner where the green walls meet and installed growth lights there to ensure survivability of our shade-tolerant plants. For sustainable growth of the green walls, we installed an automated irrigation system with driplines customized to the green wall design.

2. What is rationale behind the plant selection?

We wanted our green walls to bring balance and harmony to the users as they experience the soothing effect of nature and promote sense of well-being. Different cultivars are used to create an interesting layering tapestry to seamlessly form an almost 3D effect of the green wall. Plant species chosen were also hardy and low maintenance. For example, we chose *Philodendron hederaceum* var. *hederaceum* (Heart Leaf Philodendron) for its soft-looking heart shaped leaves and *Ophiopogon jaburan* (White Lilyturf) for its dense clumps of fine leaves to add texture and volume to the green wall that would otherwise be perceived as just a flat elevation. *Nephrolepis exaltata* 'bostoniensis' (Boston Fern) with its graceful flowy leaves was used as an accent plant to soften the look of green wall. *Tradescantia spathacea* (Boat Lily) and *Philodendron erubescens* 'Gold' were selected to add burst of colours against the darker backdrop.

Jalan Daud Residences

Landscape Implementer: Vertical Green

When a residential estate in Jalan Daud requested the installation of a massive 3-storey live green wall, it led to the highest outdoor residential green wall Vertical Green has ever embarked on. Just like a renovation project of an old house, Vertical Greenery took on the challenge of revamping a stone wall that spanned three stories in height into a lush green wall to fulfil the owner’s desire to live amidst nature.

1. Green walls in residences soften the hardscapes and provide a relaxing home environment. What is the maintenance regime that homeowners can expect for their green walls?

Our maintenance regime package is customized to cover our clients’ needs and budget. For example, this green wall would require quarterly maintenance. The maintenance of a vertical green wall of this size would typically take one full day to complete and require scaffolding to be erected onto the pool directly to allow access for maintenance. Our quarterly routine maintenance activities include pruning of plants, clearing of discolored leaves, adding of fertilizer, pest control, replacement of plants for dead plants.

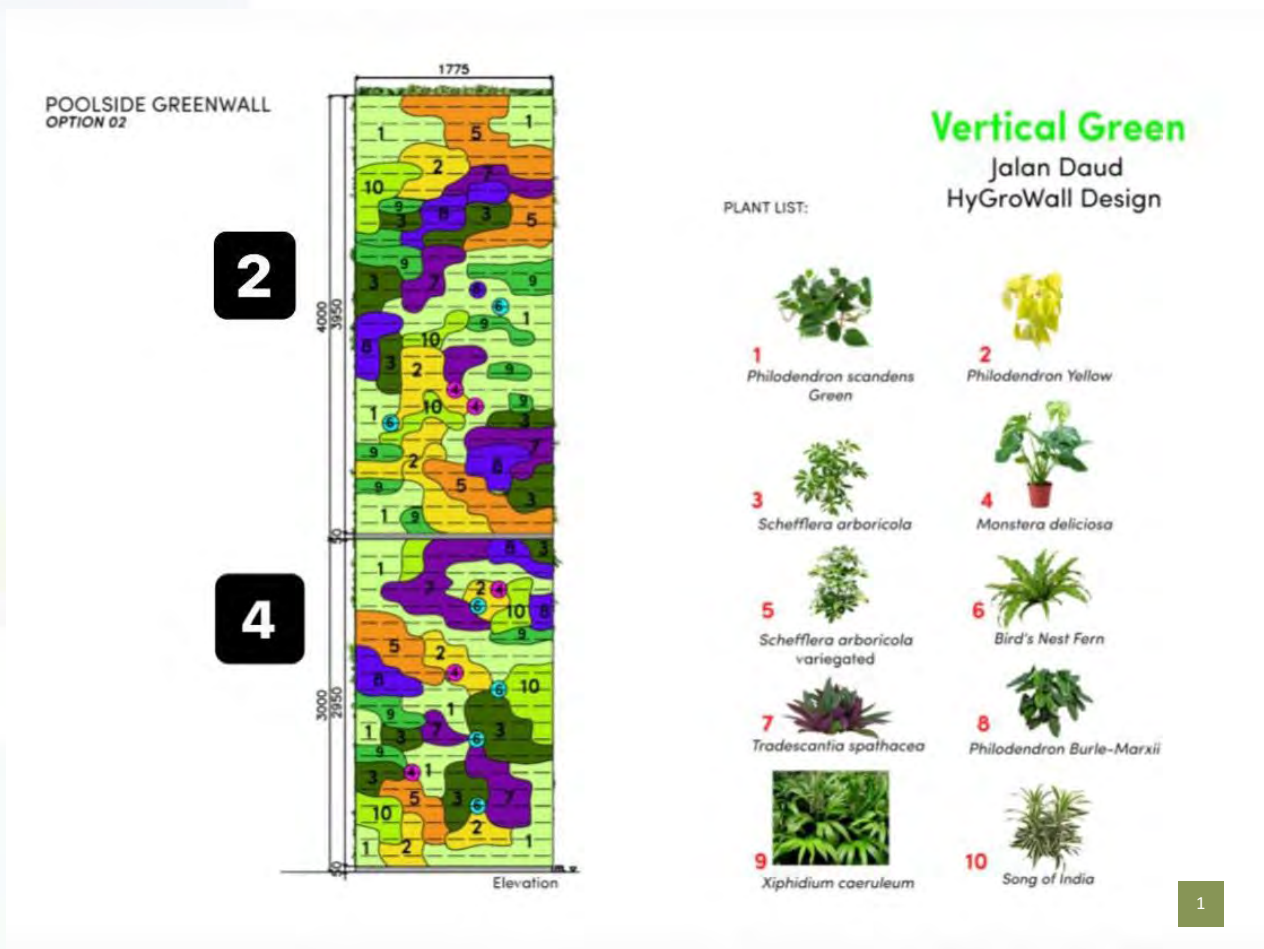


2. What guided your choice of plant palette, especially given that the green wall is located beside a pool?

Responding to the client’s design brief for naturalistic green walls, we explored the use of big leafy and tropical plants. Taking into consideration the wall’s surrounding environment, we excluded small-leaf plants to avoid excessive shedding into the pool.

(Continued next page)

The outdoor environment prompted us to use mostly hardy and lush tropical plants, including *Philodendrons*, *Monsteras* (Swiss-cheese plant), bird’s nest ferns and *Heptapleurum arboricola* 'Variegata' (*Schefflera arboricola*). Our choice of large foliage plants created a good visual impact as the lush green wall blends seamlessly into its surroundings.



3. What are the challenges you faced while installing the green wall?

As the green wall is designed to be double-sided, it is crucial for the onsite measurement of drainage trays to be exact to ensure that the trays will wrap around the walls nicely. This requires technical precision and is one of our bigger challenges during the planning, fabrication, and installation stage.

Another concern we had was the space constraint surrounding the green wall. This posed a logistical challenge to us during installation. Considering that the green wall requires a sizeable quantity of 3,000 to 4,000 plants, plants may suffer if we delay their installation on the green wall. We were in a time crunch to install the plants on the wall to preserve plant quality. As such, we had to schedule and plan the delivery of our plants to come in batches in a timely manner.

We managed to overcome these challenges and we are honoured to have played a part in enhancing our client’s quality of life and unlocking their home’s fullest living potential with a majestic green wall and lush greenery.