

**Nature-based Climate Adaptation Programme
for the Urban Areas of Penang Island**

**GEORGE TOWN AND BAYAN LEPAS
URBAN GREENING GRANTS PROGRAMME**

Terms of Reference

Developed by



With Support from



ADAPTATION FUND

In Collaboration with



UN-HABITAT



MINISTRY OF NATURAL RESOURCES,
ENVIRONMENT AND CLIMATE CHANGE



MALIS BANDARAYA PULAU PINANG



JABATAN PENGAIRAN
DAN SALIRAN MALAYSIA



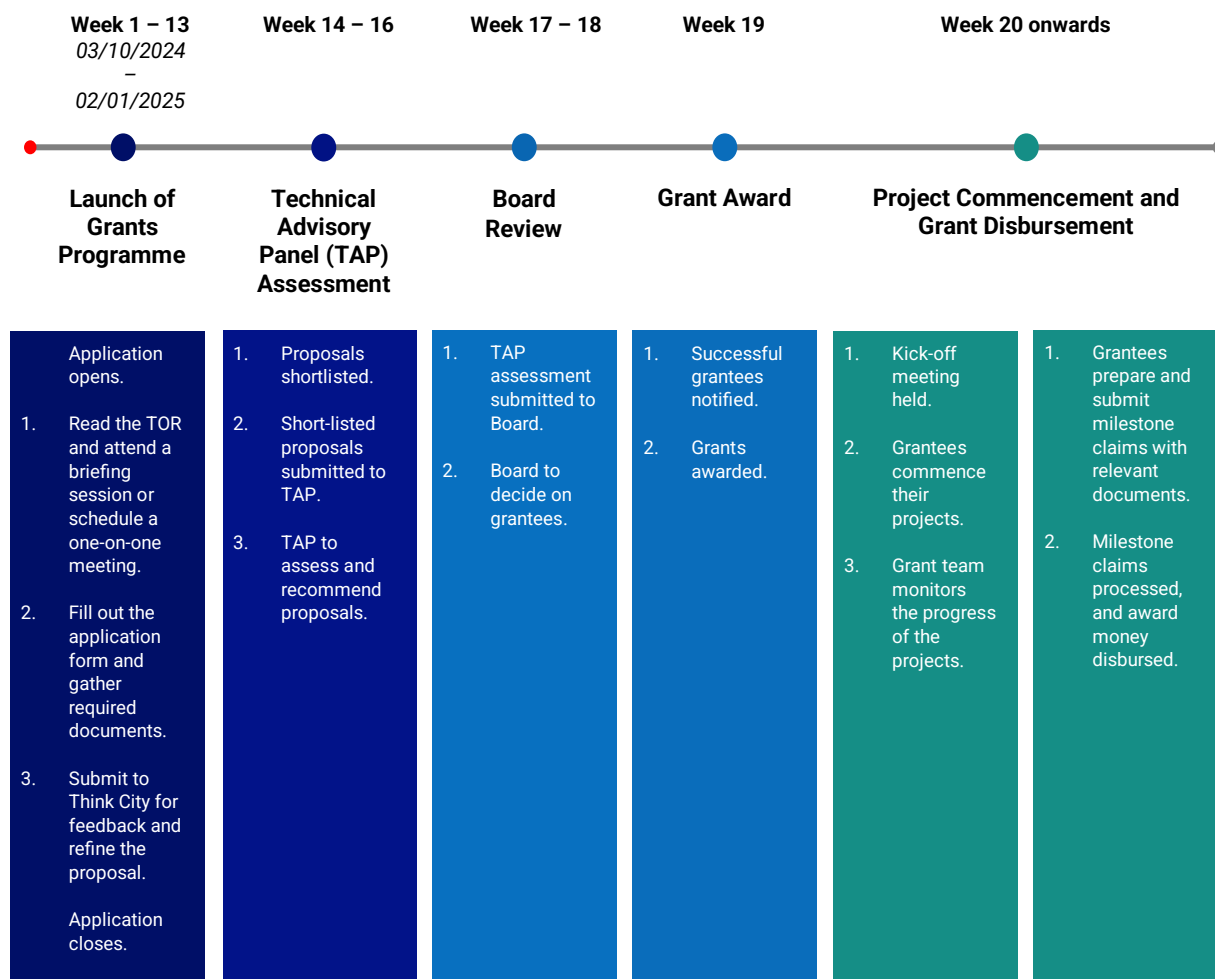
YAYASAN
HASANAH

 A foundation of Khazanah Nasional

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OVERVIEW



1. What is the Nature-based Climate Adaptation Programme for the Urban Areas of Penang Island?

In 2019, Think City, in collaboration with the United Nations Human Settlements Programme (UN-Habitat), the then-Ministry of Environment and Water (now known as the Ministry of Natural Resources, Environment and Climate Change), the Penang State Government, the City Council of Penang Island, the Department of Irrigation and Drainage, and Yayasan Hasanah, initiated Malaysia’s first urban climate adaptation programme: the *Nature-based Climate Adaptation Programme for the Urban Areas of Penang Island*. This programme was subsequently supported by the Adaptation Fund for implementation.

The programme aims to enhance urban resilience and reduce vulnerability to climate change impacts and extreme weather events by implementing Nature-based Solutions (NbS) to reduce surface temperatures and stormwater runoff while enhancing social resilience and building institutional capacity.

George Town and Bayan Lepas, two urban areas on Penang Island, were selected as focus areas for the programme due to their susceptibility to climate change impacts, existing land use, and community vulnerabilities. The programme's goals for these areas are to use NbS to:

- i) Reduce impacts of increasing temperatures and stormwater runoff, including threats to human life, infrastructure, and property associated with extreme weather events; and
- ii) Strengthen social resilience and institutional capacity.

The programme incorporates a community-focused approach and emphasises knowledge transfer to enable its methodology to be scaled and adopted by other cities in Malaysia and the region in the future.

2. What is the George Town and Bayan Lepas Urban Greening Grants Programme?

The George Town and Bayan Lepas Urban Greening Grants Programme ("programme") is part of the *Nature-based Climate Adaptation Programme for the Urban Areas of Penang Island*. This grants programme aims to increase the uptake of vertical green structures and green roofs to reduce temperatures on streets and inside buildings and to mitigate the Urban Heat Island (UHI) effect. It also seeks to promote urban greening practises, such as gardening, to build sustainable and resilient environments through nature-based approaches.

3. What are the objectives of the programme?

The programme provides funding for the introduction of green facades or roofs. Its objectives include:

- Demonstrating the effectiveness of vertical and rooftop greenery in reducing air temperatures and heat gain while improving indoor and outdoor thermal comfort.
- Showcasing NbS for both contemporary and heritage building facades to enhance thermal performance.
- Empowering communities in implementing vertical and rooftop greening.
- Increasing urban greening and biodiversity, while promoting nature-related activities such as gardening.

4. What projects are eligible for the programme?

Eligible projects must meet the following criteria:

- Introduce vertical greening or green roofs. Green roofs can be implemented on the podium level.
- For vertical greenery, the facade must face a public street or space, providing measurable benefits for the community.
- For heritage buildings or structurally unsound buildings where traditional green roofs or facades are not feasible, green facades may extend to privacy screens (see Appendix 3) if the compound is heat-stressed.
- Not involve green roofs or facades directly on Category I* listed buildings.
- Comply with relevant building control requirements set by the City Council of Penang Island, including applications for additions to building elevation, repair, or restoration permits for listed heritage buildings within the George Town World Heritage Site.
- Be located in George Town or Bayan Lepas (see attached map), on buildings or within the compounds of buildings intended for commercial, industrial, residential, institutional, or other uses.
- Not have commenced prior to the date of grant notification.

**Category I listed buildings are (a) buildings, monuments, objects, and sites of exceptional interest; (b) buildings and monuments declared as ancient and gazetted formerly under the Antiquities Act 1976, now under the National Heritage Act (2005); (c) buildings and monuments registered as National Heritage under the National Heritage Act (2005). Source: George Town Historic Cities of the Straits Malacca Special Area Plan, D4-1, 2016.*



5. Who can apply for the programme?

The programme is open to individuals, collectives, community-based organisations, non-governmental organisations*, and semi-government controlled educational institutions that meet the eligibility criteria. The lead applicant must assume full administrative responsibility and be actively throughout the entire process.

**Organisations registered under the Registrar of Companies, Registrar of Societies, and Registrar of Businesses are welcome to apply.*

6. What does the programme support?

The programme supports direct expenses for implementing green façades or roofs, with a maximum grant amount of RM100,000 per application. It prioritises projects that:

- Demonstrate significant potential for reducing temperatures.
- Feature a high level of co-investment.
- Exhibit high standards in design, materials, and execution.
- Involve the community and/or provide public access.
- Benefit biodiversity,
- Have a vegetation coverage for green facades of at least 1,110 m²
- Have a vegetation coverage for green rooftops of at least 3,750 m²
- Can be completed within 6 months.

7. What are the expected outcomes for the programme?

Eligible projects are expected to deliver the following outcomes:

- i) Introduce a green façade or roof with substantial vegetation cover and visual appeal for the benefit of the general public (refer to Appendix 1);
- ii) Reduce air temperature in adjacent spaces and provide evidence through valid data points or records;
- iii) Reduce heat gain in buildings and cooling demand/energy use, and demonstrate evidence through valid data points or records for green roofs or facades directly or indirectly applied to a building;
- iv) Promote good practices in vertical and horizontal greening implementation, including long-term sustainability. The proposed project must include a maintenance manual submitted in the final report and a commitment to maintaining the green façade or roof for at least 3 years.

8. What scope of work does the programme support, and what costs are not covered?

Scope	Examples	Can it be Covered by the Grant?	Can it be Part of the Co-funding Contribution?
Professional Consultancy Fees	Landscape architect	Yes, up to 100%	Yes
	Architect		
	Structural engineer		
	Facade specialist		
	Certified arborist		
Administrative	Permit application processing fee	Yes, up to 100%	Yes
	Legal fees		
Project Management	Project coordination	Yes, up to 50%	Yes
	Project oversight		
Construction	All necessary labour and construction activities	Yes, up to 100%	Yes
Supplies and Material	Plants	Yes, up to 100%	Yes
	Soil/mulch		
	Irrigation lines		
	Waterproofing membranes		
	Supporting structures		
	Modular panels		
Structural Renovation	Planter boxes	No	Yes
	Reinforcement of load-bearing elements		
	Structural repairs and modifications		
Maintenance for 3 Years	Upgrades to meet safety codes	Yes, up to 30%	Yes
	Routine inspections		
	Repairs		
Tools	General upkeep	No	No
	Shovels		
	Wheelbarrows		
Personal Protective Equipment	Trowels	No	No
	Helmets		
	Gloves		
Travel	Eye protection	No	No
	Transportation		
	Accommodation		
	Per diem costs		

Note: These examples are non-exhaustive, and submissions will be evaluated on a case-by-case basis.

9. What are the application requirements and documents?

Applicants must attend a grant briefing session organised by Think City or schedule a one-on-one meeting with Think City if unable to attend.

Required documents to include in your submission (in PDF format) are:

- Completed application form
- Applicant's CV/profile/portfolio
- Detailed project cost breakdown
- Project timeline with key milestones
- A copy of the property title or written consent from the property owner to prove ownership/consent
- Letter of Undertaking for a minimum three-year maintenance period after project completion
- Proof of mailing address (if applicable)
- Company details – Certificate of Registration with Registrar of Companies/Societies/Business – Form 9, 13, 24, 44, 49, M&A (if applicable)
- Photographs of the project site
- Design drawings and specifications

Note: A post-grant assessment will be requested if the application is accepted

10. How can you apply for the programme?

Please download the application form at:

www.thinkcity.com.my/PNBCAPUrbanGreeningGrants

Please submit your application and relevant documents to the official email:

pnbcap@thinkcity.com.my

Please note that you must attend a grant briefing session organised by Think City, or if unable to attend a session, schedule a one-on-one meeting with Think City. Dates and venues for the briefing sessions will be announced on the Think City website and communicated across all relevant Think City platforms.

11. How will the applications be assessed?

Applications will be assessed against the following criteria:

Criteria	Weightage
Impact <ul style="list-style-type: none"> • Effectiveness in reducing the UHI effect, including location in high UHI effect areas (refer to Appendix 2) 	40
Community and Environmental Benefits <ul style="list-style-type: none"> • Public benefit and community involvement • Biodiversity benefits 	20
Suitability and Feasibility <ul style="list-style-type: none"> • Stakeholder support • Compliance with policies • Greening considerations (refer to Appendix 3) • Realistic budget and value for money 	20
Sustainability <ul style="list-style-type: none"> • Impact evaluation methodology • Maintenance strategy 	20

12. What happens after the applications are assessed?

Successful Applications: Successful applicants will receive an official email with a Letter of Offer (LOO), valid for seven days. If not accepted within this period, the offer will lapse. Grantees will attend an Approved Application Workshop and receive a Letter of Award (LOA) detailing the grant amount, terms, conditions, and milestone deliverables.

Unsuccessful Applications: Unsuccessful applicants will be notified via email if not shortlisted. Appeals are not accepted; decisions are final.

13. How will you receive funding?

Funding will be disbursed upon completion of the agreed milestones and deliverables, following the submission of a payment request form. The funding will be transferred within 30 days of the approved submission and sign-off of the milestone report to the recognised bank account of the grantee.

14. What are the deliverables and reporting requirements?

Throughout the grant period, grantees must:

- Deliver the project within the grant period outlined in the Letter of Award (LOA) and adhere to the agreed reporting requirements.
- Maintain regular contact with Think City to provide updates on project progress or report any changes in the scope of work or timeline.
- Acknowledge Think City's support through relevant media platforms and adhere to Think City's brand guidelines.

After each milestone, grantees must:

- Submit a Milestone Report
- Arrange a site assessment

At the end of the project, grantees must submit the following:

- Project Closure Report.
- Outcome Assessment Survey (to be submitted within 14 days post-completion) (provided by Think City).
- Financial statement of the actual budget utilisation (template provided by Think City).
- Documentation of the process, outcomes, and data collected.
- Maintenance manual for the green façade or roof.
- Any supplementary materials (e.g., photography, videos, and collaterals created).

Note: Think City will provide thermal imagery of the surrounding area before and after the installation of the green rooftop or façade.

Think City reserves the right to revoke approvals should there be:

- Unapproved scope changes.
- Failure to complete the project as proposed without valid justification.
- Breach of terms and conditions specified and agreed upon in the LOA.

15. Are there any maintenance requirements after project completion?

The project's green façade or roof must be a permanent installation and maintained for at least three (3) years after completion. The grantee must ensure the green façade or roof is maintained even if there is a change in building ownership within the minimum maintenance period. If the installation is removed before the minimum maintenance period, the full grant amount provided by Think City will be recovered.

16. Who can you contact if you have any questions?

If you have any questions or wish to discuss your application in detail, please contact us at +6011-3790-7803 or email pnbcap@thinkcity.com.my with your enquiries or to schedule an appointment.

About Think City

Think City is an impact organisation established in 2009 to create more sustainable and equitable places for the benefit of all. Our knowledge, skills, and strategies focus on urban solutions, the environment, social communities, and the cultural economy. Think City is a wholly owned subsidiary of Khazanah Nasional Berhad (the sovereign wealth fund of the Government of Malaysia). For more information, log on to www.thinkcity.com.my.

APPENDIX 1: General Reference Images



Vo Trong Nghia Architects

Terms of Reference

GEORGE TOWN AND BAYAN LEPAS URBAN GREENING GRANTS PROGRAMME



Villa M - Triptyque



DIE UMWELTBERATUNG



Sihl City Shopping Centre



Vo Trong Nghia Architects



Vo Trong Nghia Architects



Vo Trong Nghia Architects

APPENDIX 2: Priority Areas within George Town and Bayan Lepas with High UHI Effect

Interactive land surface temperature maps for George Town and Bayan Lepas can be found here:

1. <https://maps.thinkcity.com.my/think-city/maps/114370/Land-Surface-Temperature-of-George-Town#>
2. <https://maps.thinkcity.com.my/think-city/maps/114831/Land-Surface-Temperature-of-Bayan-Lepas#>

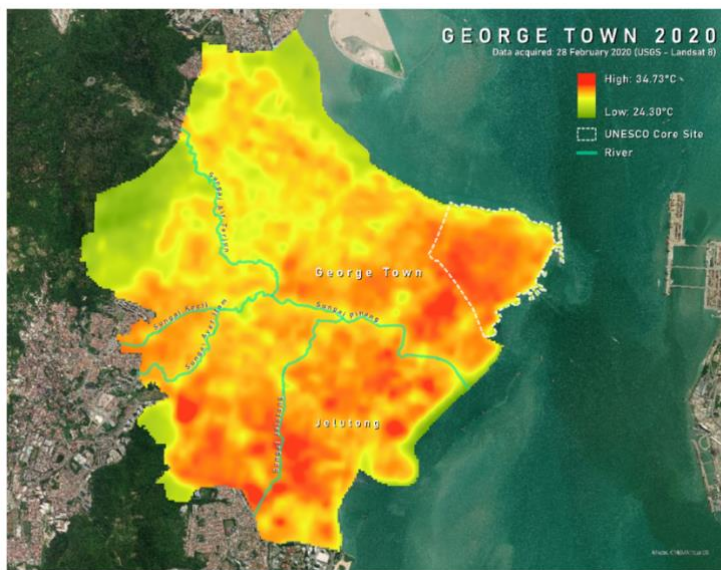


Image Source: Think City

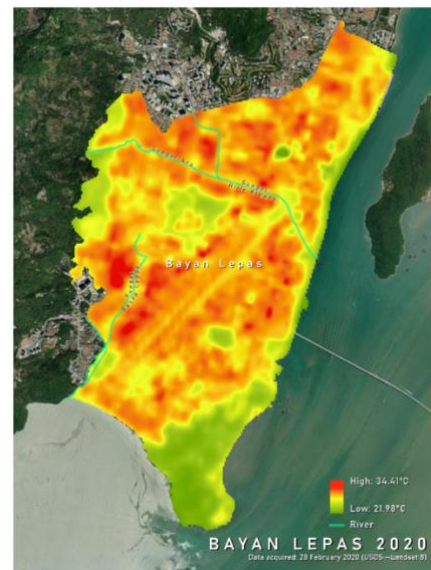


Image Source: Think City

APPENDIX 3: Technical Guidelines/Guidance Notes (For Reference Only)

Vertical Greening

Vertical greening typically involves integrating vegetation on building envelopes, offering benefits such as improved air quality, increased urban biodiversity, reduced urban heat island (UHI) effect, and reduced energy consumption. As a passive cooling system, vertical greening or green facades facilitate evapotranspiration, provide shading, and offer insulation¹.

In recent years, the types and forms of vertical greening have evolved, offering various alternatives for incorporating vegetation onto building surfaces. Vertical greening can be divided into two categories, both of which apply to this grants scheme:

1) Direct Green Facade

This involves the use of plants with self-clinging mechanisms that attach directly to the building surface. In a direct green facade, climbing plants are rooted in the ground, facilitating irrigation. As a result, this type of green façade is usually cheaper to install and maintain.

However, there is a risk of damage to building wall due to the growth pattern and weight of some climbing plants².

2) Indirect Green Facade

An indirect green façade requires vertical structural support to guide the growth of selected plants along the building wall. Plants are grown from a trench below or planter boxes at intermediate levels, and this type of façade includes an integrated irrigation system and damp-proof backing or membrane.

3) Privacy Screen

Privacy screens use vegetation to create visual and spatial separation within outdoor spaces, offering enhanced privacy while also contributing to the aesthetics and functionality of a landscape. A well-designed privacy screen can serve multiple purposes, including blocking unwanted views, providing shelter from wind, and adding to the overall landscape appeal.

Key Considerations for Privacy Screens:

- **Combination of Species:** Use a mix of plant types to enhance resilience and visual interest. A variety of plants can withstand pests and diseases better than a single-species screen, and they can offer different textures and colors.

¹ Briz J, Felipe Boente M. I. de & Köhler Manfred. (2019). *Multifunctional urban green infrastructure*. Editorial Agrícola Española.

² Al-Kayiem, H.H.; Koh, K.; Riyadi, T.W.B.; Effendy, M. A Comparative Review on Greenery Ecosystems and Their Impacts on Sustainability of Building Environment. *Sustainability* **2020**, *12*, 8529.

- Spacing: Avoid planting screens too close together to prevent competition for resources as plants mature. Space plants according to their full-grown size to ensure proper growth and effectiveness.
- Height and Density: Choose plants that will achieve the desired height and density for privacy. Taller plants or a combination of varying heights can create a more effective barrier.
- Maintenance: Select low-maintenance plants where possible to reduce the effort needed for upkeep. Be aware of potential issues such as leaf drop or pests that may require attention.
- Climate and Soil: Choose plants that are well-suited to the local climate and soil conditions. For instance, plants like Boxwoods and Arborvitae are suitable for certain climates but may face challenges in others due to pests or disease.

The following are types of vertical structural support typically used³:

Technical Notes

- High-maintenance solutions, such as Patrick Blanc's vertical garden are discouraged;
- Plant boxes can be used if they are aligned with the façade;
- Easy access for watering and maintenance must be ensured; and
- The main type of plants to be used are vines, although herbaceous plants and small shrubs may also be considered for plant boxes.

³ State of New South Wales and Office of Environment and Heritage (2015) Urban Green Cover in NSW.

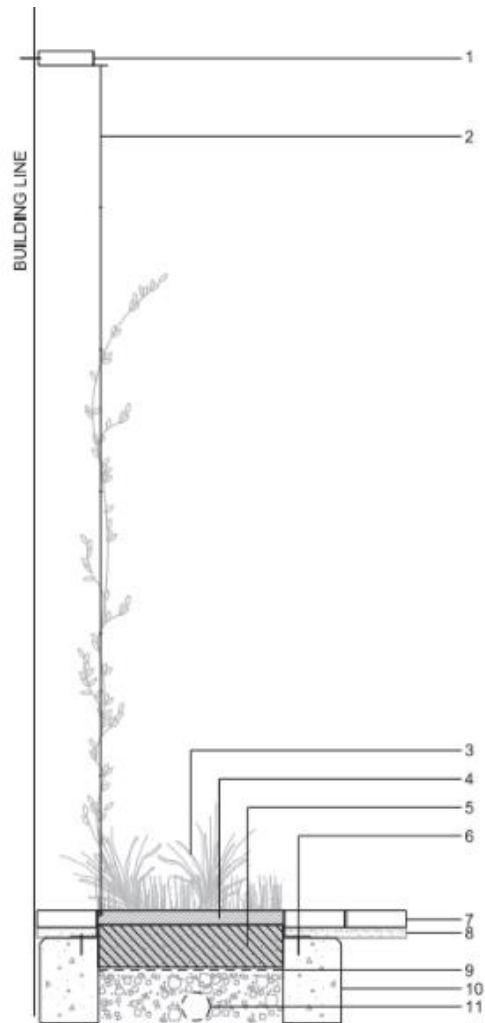
1) Cable and wire net system

CABLE AND WIRE NET SYSTEM

NOTE:

- Planting can be integrated into footpath or building apron or in an above ground planter box.

- | | |
|----|---|
| 1 | BUILDING ANCHOR AND BRACKET SYSTEM |
| 2 | STAINLESS STEEL CABLE OR WIRE NET |
| 3 | PLANTING |
| 4 | MULCH (50mm) |
| 5 | SOIL TYPE 1 |
| 6 | GALVANISED STEEL ANGLE |
| 7 | PAVING |
| 8 | BEDDING COURSE |
| 9 | GEOFABRIC FILTER LAYER |
| 10 | CONCRETE HAUNCH |
| 11 | SUBSOIL DRAINAGE PIPE WITHIN 20mm GRAVEL (NO FINES) |



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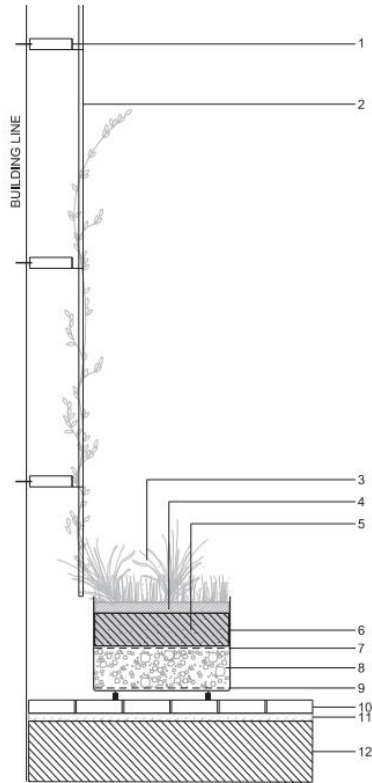
2) Trellis and container system

TRELLIS AND CONTAINER SYSTEM

NOTE:

- Planting can be integrated into footpath or building apron or in an above ground planter box.

- | | |
|----|--|
| 1 | BUILDING ANCHOR AND BRACKET SYSTEM |
| 2 | TRELLIS SYSTEM FIXED TO BUILDING ANCHORS |
| 3 | PLANTING |
| 4 | MULCH (50mm) |
| 5 | SOIL TYPE 1 |
| 6 | GALVANISED STEEL PLANTER |
| 7 | GEOFABRIC FILTER LAYER |
| 8 | 20mm GRAVEL (NO FINES) LAYER |
| 9 | GEOFABRIC FILTER LAYER |
| 10 | PAVING |
| 11 | BEDDING COURSE |
| 12 | EXISTING PAVING SUBSTRATE |



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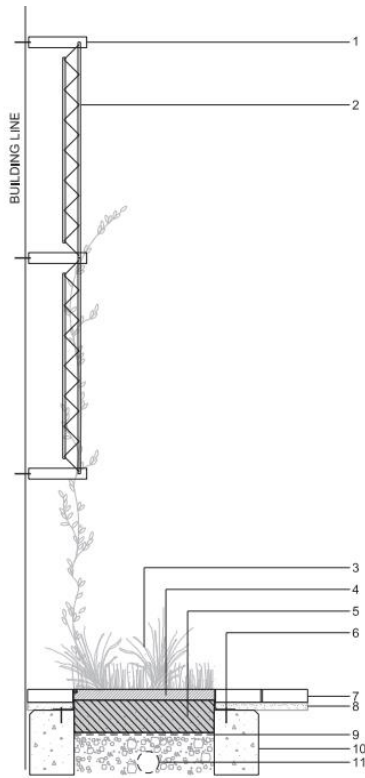
3) Modular trellis panels

MODULAR TRELLIS PANELS

NOTE:

- Planting can be integrated into footpath or building apron or in an above ground planter box.

- | | |
|----|---|
| 1 | BUILDING ANCHOR AND BRACKET SYSTEM |
| 2 | STAINLESS STEEL CABLE OR WIRE NET |
| 3 | PLANTING |
| 4 | MULCH (50mm) |
| 5 | SOIL TYPE 1 |
| 6 | GALVANISED STEEL ANGLE |
| 7 | PAVING |
| 8 | BEDDING COURSE |
| 9 | GEOFABRIC FILTER LAYER |
| 10 | CONCRETE HAUNCH |
| 11 | SUBSOIL DRAINAGE PIPE WITHIN 20mm GRAVEL (NO FINES) |



Section Scale 1:20

TERMS OF REFERENCE

GEORGE TOWN AND BAYAN LEPAS URBAN GREENING GRANTS PROGRAMME

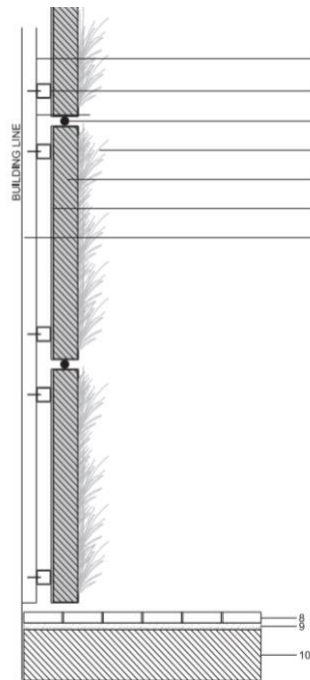
4) Modular panel system

MODULAR PANEL SYSTEM

NOTE:

- Planting can be integrated into footpath or building apron or in an above ground planter box.

1	STAINLESS STEEL WALL CHANNEL
2	STAINLESS STEEL PURLIN FIXED TO WALL CHANNEL
3	IRRIGATION LINE
4	PLANTS
5	GROWING MEDIUM
6	WALL PANEL
7	WATERPROOF MEMBRANE
8	PAVING
9	BEDDING COURSE
10	EXISTING PAVING SUBSTRATE



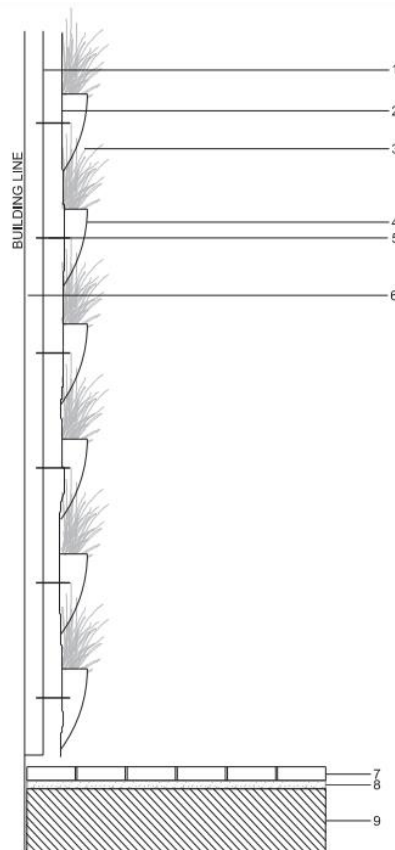
5) Felt/ Mat system

FELT/MAT SYSTEM

NOTE:

- Planting can be integrated into footpath or building apron or in an above ground planter box.

1	STAINLESS STEEL WALL CHANNEL
2	FELT LAYER
3	PLANTS
4	POCKET
5	TIE
6	WATERPROOF MEMBRANE
7	PAVING
8	BEDDING COURSE
9	EXISTING PAVING SUBSTRATE



TERMS OF REFERENCE

GEORGE TOWN AND BAYAN LEPAS URBAN GREENING GRANTS PROGRAMME

Rooftop Greening

Rooftop greening refers to a vegetated landscape built from a series of layers that are loosely grown or modularly placed on a roof surface (installed layer by layer on the roof or as pre-prepared layers in trays and planter boxes). When appropriately designed, rooftop greening can significantly enhance building performance, including improved air quality, better acoustic insulation, increased durability of waterproof barriers, reduced urban heat island effect, improved rainwater retention, and greater energy efficiency⁴.

'Biodiverse green roofs' are specially designed and planted to enhance local plant diversity and provide habitat (food and protection) for wildlife⁵.

For existing buildings where a roof garden is being proposed, the load-bearing capacity must be considered. Only accessible roofs should be considered, as they have higher load capacities. The load capacity of the roof and building should be verified and ideally be approximately 400 kg/m². If the load capacity is lower (the minimum admissible is 200kg/m²), the proposal should be adjusted accordingly, particularly the height of the topsoil in the planters (wet topsoil weighs approximately 1,600kg/m³⁶). Planters should not be distributed in a continuous manner to avoid placing them on top of expansion joints. This ensures accessibility for maintenance and proper distribution of the load across the structure.

Technical Notes

- Only roofs with a minimum load capacity of 200kg/m² should be considered;
- The integrity of the structure is a major concern, so the load-bearing capacity should not be exceeded. Planters to be placed on the roof should be made of lightweight materials, such as wood or recycled plastic. Heavy materials, such as concrete or stone, should be excluded;
- Plants should be introduced in plant boxes, except in the case of new construction*;
- Plant boxes should not be placed on top of expansion joints;
- The drainage system should not be obstructed in any way;
- Plant boxes must have a maximum soil height of 0.30 m, except for isolated plant boxes placed on top of pillars (with no expansion joints), which can have a maximum soil height of 0.60 m. The volume of soil and its distribution should be calculated according to the load capacity of the roof; and
- The plants used should be herbaceous plants and vegetables and shrubs or vines for larger plant boxes.

*Buildings under construction may be considered for the grants programme. The rules for these cases will differ, requiring coordination with waterproofing, structural, and drainage engineering work.

⁴ National Parks Board – Skyrise Greenery Incentive Scheme (2022) <https://www.nparks.gov.sg/skyrisegreenery/explore/rooftop-greenery>

⁵ State of Victoria through the Department of Environment and Primary Industries (2014) Growing Green Guide: A guide to green roofs, walls and facades in Melbourne and Victoria, Australia

⁶ University of Delaware (2015) Analysis of the Weight of the Smart Roof Deck Garden.

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GEORGE TOWN AND BAYAN LEPAS URBAN GREENING GRANTS PROGRAMME

Plant Selection

A careful selection of plants is integral to the success of vertical and rooftop greening. When selecting plant species, consider characteristics such as growth rate, density, leaf area and coverage, climbing pattern, susceptibility to pests and diseases, and maintenance requirements. Crucially, selecting plant species will also depend on their availability in local nurseries and the desired design intent and visual effect⁷. Plants that benefit urban biodiversity are encouraged.

The following list of recommended plants for green facades and green roofs can serve as a reference when selecting suitable species based on the specific context and environmental factors:

Suggested Plant Species by National Parks Board, Singapore for Skyrise Greenery
<https://www.nparks.gov.sg/skyrisegreenery/resources/plant-resources>

⁷ Al-Kayiem, H.H.; Koh, K.; Riyadi, T.W.B.; Effendy, M. A Comparative Review on Greenery Ecosystems and Their Impacts on Sustainability of Building Environment. *Sustainability* **2020**, *12*, 8529.