



Green Mark 2021

Re

TECHNICAL GUIDE

Revision Log

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RE1 Protect

A maximum of 5 points can be scored across RE 1 Protect section.

RE1.1a Habitat and Ecology

Environmental Impact Assessment (EIA) is one of the environmental tools used by developers and building owners to assess potential impacts their proposed development can have on the environment, identify key concerns areas to focus the mitigation efforts to avoid or minimise these environmental impacts. The assessment shall be conducted prior to the commencement of activities on site.

Assessment Criteria

RE1.1a Habitat and Ecology	New Buildings	Existing Buildings
(i) A comprehensive Environmental Impact Assessment (EIA) to identify the anticipated effects on the environment a proposed development or project may have.	1 Point	1 Point
(ii) Implementation plan that outlines key actions that needs to be undertaken to maintain the ecological integrity of biodiversity on the site, whether this is existing biodiversity or created as a part of the development works.	1 Point	1 Point

- (i) The EIA shall identify design measures to mitigate negative impacts to the site environment with a focus on climate change and ecological systems. It should describe how the project can contribute positively to the overall ecology and biodiversity of the site and its wider context. Point shall be awarded for a comprehensive **Environmental Impact Assessment (EIA)** covering the followings:
- Identify anticipated environmental impacts/effects of a proposed development or project may have.
 - Identify measures to mitigate the negative impacts It should describe how the project can contribute positively to the overall ecology and biodiversity of the site and its wider context.
- (ii) Point shall be awarded for the **implementation of the mitigation measures**.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Submission of an environmental study report or an Environmental Impact Assessment (EIA) by competent EIA specialists and the report shall be acknowledged and endorsed by the client or client representative.

At Verification stage (New Buildings & Existing Buildings):

- Documentary evidence and photographs of implementation of the environmental mitigation measures undertaken during the construction and operation of the building.

Guidance Notes

As a guide, the EIA report shall include but not limited to the following details:

- Project description - description of project, site location, its design, construction activities and construction schedules.
- Description of the environment and baselines – The current environmental conditions and existing baseline conditions will help assess the environmental quality and ecosystem health of the site. It will

give an understanding of how far the current environmental conditions have deviated from the values expected in quality guidelines and standards.

- c) Identification of environmental impact – identify the potential environmental impacts on biodiversity, soil erosion, water quality, noise, air quality and waste by the project including the land preparation, during the construction of the project and operational phase period.

For example, the site clearance and earthworks will remove the trees and vegetation. The possible impacts include loss of flora and fauna from the site, soil erosion, water quality (the runoff from exposed soil can potentially be contaminated with contaminants from construction wastes), waste generation from tree felling and site clearance; and noise and air emissions (due to construction equipment and machinery). Similarly, the building construction activities can have impacts on the water quality (increased turbidity of water due to pollutants from construction site, waste generation, noise and air emission (due to construction equipment and machinery) and vibration during piling works.

The environmental impact on the building itself or during the operational phase should also be considered. *For example, for buildings located close to green spaces to consider the potential impacts e.g. bird collisions. Another example is how the building roofs and pavements can lead to increased volume of storm water or run-off across the areas covered by the buildings and increase the rate of flow entering the drainage system. This could result in overflow and damage to the increased erosion or water logging in the neighbouring areas.*

- d) Mitigation of environmental impacts – This section outlines the recommendations and measures to mitigate any adverse impacts of the proposed development on the surrounding environment and opportunities to improve the site beyond its original condition before the development, i.e. how the ecological features or areas of the site are to be adequately protected from damage or disturbance during the construction activities from site clearance and preparation through to practical completion and handover.

For example, the mitigation measures to control water pollution during construction is to minimize the amount of pollutants that go into the water, the main contractor should always ensure that all chemicals, dirt and soil are contained or properly covered. Paint and fuel (such as diesel and gasoline) containers should always be covered tightly and placed in dry areas that are not exposed to rain and flood.

- e) Conclusion and Recommendations

References

- *Environmental Impact Assessment:*
<https://www.ura.gov.sg/Corporate/Planning/Our-Planning-Process/Bringing-plans-to-Reality/Environmental-Impact-Assessment>
- *Biodiversity Impact Assessment (BIA) Guidelines:*
<https://www.nparks.gov.sg/biodiversity/urban-biodiversity/biodiversity-impact-assessment-guidelines>
- *Environmental Protection Agency, Ireland (2022) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)'; Retrieved: <https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment.php>*
- *European Commission (2015) 'Environmental Impact Assessment Guidance'; Retrieved: <http://ec.europa.eu/environment/eia/eia-support.htm>*

RE1.1b Resources

Assessment Criteria

RE1.1b Resources	New Buildings	Existing Buildings
(i) Asset Sustainable Policy and Action Plan shall include:		(Cap at 3 Points)
a) Energy Management Policy and Energy Improvement Plan	N/A	1 Point
b) Water Management Policy and Water Improvement Plan	N/A	1 Point
c) Waste Management Policy and 3R Plan	N/A	1 Point
(ii) a) PUB Water Efficient Building (Basic) certification	N/A	0.5 Point OR
b) PUB WELS “3-ticks” rating for 90% of all relevant water fittings	1 Point	1 Point

(i) Sustainable Policy and Action Plan

Assessment Criteria

Points shall be awarded for providing an Asset Sustainable Policy and Action Plan consisting of an energy management policy and energy improvement plan, a water management policy and water improvement plan, and a waste management policy and 3R plan.

Documentation Requirements

Pre-retrofit stage (Existing Buildings):

- Not applicable

At Verification stage (Existing Buildings):

- (a) Energy Management Policy and Energy Improvement Plan

Adoption and implementation of an Energy Management Policy, which is a written document endorsed by the top management, stating the building owner’s commitment towards the way the building consumes energy as well as targets on energy savings that the building endeavors to achieve. The Energy Improvement Plan shall state the various measures and/or works that the building will undertake over the next 3 years to achieve the energy savings target.

- (b) Water Management Policy and Water Improvement Plan

Adoption and implementation of a Water Management Policy, which is a written document endorsed by the top management, stating the building owner’s commitment towards the way the building consume water as well as targets on water savings that the building endeavors to achieve. The Water Improvement Plan shall state the various measures and/or works that the building will undertake over the next 3 years to achieve the target set for water consumption reduction.

- (c) Waste Management Policy and 3R Plan

Adoption and implementation of a Waste Management Policy, which is a written document endorsed by the top management, stating the building owner’s commitment towards the way the building handles waste. The 3R Plan or Programme documents the waste management practices and identify opportunities to reduce, reuse and recycle waste materials to reduce waste disposal needs. This policy should also include the organisation’s approach to reducing use of single-use items and encourage reusables where possible (i.e. use of reusable cups for meetings, use reusable takeaway containers and bags).

Guidance Notes

The Improvement Plan establishes and summarises the key actions which identify measures in energy/water savings and provides implementation timelines by management to meet the commitments in the reduction for energy and water consumption. The Plan shall include the following information:

- a) description of energy and water efficiency measures to be implemented for next 3 years
- b) projected reduction in energy and water consumption in kWh/yr or m³/yr, or percentage savings.
- c) endorsement by senior management

1) The following list of energy efficiency measures (not exhaustive) can be included in the Energy Improvement Plan, where applicable:

- a) Replace inefficient lightings e.g. CFL, T8 fluorescent, etc. with the more efficient LED lightings including LED exit signs
- b) Use of energy efficient equipment and appliances under NEA Mandatory Energy Labelling Scheme (MELS) and Minimum Energy Performance Standards (MEPS) and SGBC's certified products
- c) Install power sub-meters for highly utilised equipment/system to monitor the energy consumption
- d) Switch to high efficiency motors or EC fan motors for cooling towers and air handling units (AHU)
- e) Install solar photovoltaic panels to generate electricity
- f) Install Carbon Monoxide (CO) sensors to control the operation of the ventilation system in enclosed car parks

2) For Water Improvement Plan, building owners can consider the following measures (not exhaustive), where applicable:

- a) Install water sub-meters to track and monitor water usage for areas having large water consumption
- b) Replace with more efficient water fittings or "3-ticks" rating under PUB WELS rated water fittings
- c) Use of drought resistant plants that require less irrigation
- d) Use non-potable water for cooling towers, either from NEWater or AHU condensate water
- e) For landscape and greenery, use drip irrigation system which uses less water than sprinkler irrigation

Reference: <https://www.pub.gov.sg/savewater/atwork>

3) For Waste management, it is a good practice to monitor the total amount of waste the building generates and how much of this is being recycled or sent to incineration and landfill. From monitoring, building owners can find opportunities to increase recycling efforts and reduce the amount of waste sent to incineration and landfill.

Some of the good practices and opportunities for waste minimisation (not exhaustive), are outlined here:

- a) Provide water jugs with reusable cups or water stations for refilling of bottles instead of providing disposable water bottles for meetings.
- b) Use of products with recycled content or less packaging
- c) Work with suppliers to deliver goods without or with less packaging
- d) Track and cap the amount of printing and photocopying of each employee and department
- e) Use of reusable crockery and cutlery when catering

Building owners can refer to NEA's website for the [3R guidebooks](#) for hotels, offices, shopping malls, schools and industrial building that explains the benefits of the 3Rs and how to implement the 3R programme.

(ii) Water Efficient Fittings

Assessment Criteria

RE1.1b Resources	New Buildings	Existing Buildings
(iv) a) PUB Water Efficient Building (Basic) certification	N/A	0.5 Point
b) PUB WELS “3-ticks” rating for 90% of all relevant water fittings	1 Point	OR 1 Point

a) PUB Water Efficient Building (WEB) certification

Points shall be awarded for Existing Buildings which have attained a PUB Water Efficient Building (Basic) certification.

OR

b) Efficient Water Fittings

Points shall be awarded for buildings with **at least 90%** of the following water fittings having 3-ticks rating under PUB’s Water Efficiency Labelling Scheme (WELS):

- Basin taps and mixers
- Showers taps and mixers
- Sink/ Bib taps and mixers
- Urinals and urinal flush valves
- Dual flushing cistern for WC
- WC flush valves

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

For (a) PUB WEB certification: Not applicable

For (b) Efficient Water Fittings:

- Tender specification showing the quantity, WELS rating and brands/models of the designed water fittings
- A table showing the quantity, types and the WELS rating of the water fittings; and percentage of the 3-ticks rating in the prescribed tabulated format shown below:

Water Fitting Type	Quantity		Total Qty
	3-ticks	Other ratings	
Basin Taps & Mixers			
Sink Taps & Mixers			
Shower Taps & Mixers			
Urinals and urinal flush valves			
Dual-Flush Flushing Cisterns			
WC flush valves			
Total No. of fittings			
Percentage of 3-ticks rating			

At Verification stage (New Buildings & Existing Buildings):

For (a): A valid PUB Water Efficient Building (WEB) Certification.

For (b): Purchase/ Delivery orders and water fittings schedule showing the quantity, WELS rating and brands/ models of the installed water fittings. Any changes in water fittings installed with require a re-tabulation to demonstrate at 90% of the relevant water fittings have 3-ticks rating under PUB’s WELS.

RE1.2a Outdoor Thermal Comfort

The quality of urban outdoor environment has an impact on the liveability and well-being of its population, Therefore, in the stages of urban planning, landscape and architectural designs, outdoor thermal comfort is an important consideration to maintain a cool and comfortable living environment and mitigate the impacts of global warming and urban heat island effects.

One of the strategies to design and maintain conducive outdoor thermal comfort is using microclimatic modelling tools. This would allow users to simulate the combined effect of external climate conditions (wind and temperature) and the development’s impact on the surrounding area’s thermal comfort.

Assessment Criteria

RE1.2a Outdoor Thermal Comfort	New Buildings	Existing Buildings
<p>To conduct environmental modelling of the site to demonstrate that outdoor thermal comfort is maintained or improved and UHI effect minimised or reduced. Developments should identify and implement suitable interventions to mitigate the urban heat island (UHI) effect through massing, material selection, the landscape, (hardscape, softscape) and building surfaces.</p> <p>Model shall show one of the following results:</p> <ul style="list-style-type: none">• Physiological Equivalent Temperature (PET) of $\leq 34^{\circ}\text{C}$• Universal Thermal Climate Index (UTCI) of $\leq 32^{\circ}\text{C}$• TSV $< +2$	2 Points	2 Points

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

Evidence of the use of modelling simulation tools to demonstrate how at least one is the indicators is achieved.

At Verification stage (New Buildings & Existing Buildings):

Not applicable

Guidance Notes

The environmental modelling for Outdoor Thermal Comfort analysis shall be carried out using well validated software. Examples of these simulation tools are (1) Integrated Environmental Modeller (IEM), (2) RayMan and (3) Envi-met. There are other modelling workflows that tap into open-source tools and plug ins (such as Grasshopper/Ladybug) to calculate UTCI, and there are more urban system solutions in development at the time of writing.

The simulation shall be based on the Outdoor Area (defined as the site area less the GFA footprint of the building) and includes all accessible landscape and occupiable areas where people are more likely to have outdoor activities.

Model shall be conducted using simulations over the site area, based on 12 pm (Noon) readings for a typical day in April and October months.

There are 3 indicators which are commonly used in the various modelling software for outdoor thermal comfort. Either of the below indicators would be accepted. The simulation shall achieve the below indicators for 100% of the outdoor area.

(1) Physiological Equivalent Temperature (PET) and (2) Universal Thermal Comfort Index (UTCI)

Both indicators integrate meteorological parameters (air temperature, relative humidity, wind speed and average radiant temperature) and personal factors (clothing and metabolic rate).

Thermal perception	PET range for Singapore (°C PET)
Slightly cold	20 – 24
Neutral	24 – 30
Slightly warm	30 – 34
Warm	34 – 38
Hot	38 – 42
Very hot	>42

UTCI (°C)	Stress Category	Thermal perception
0 – 9	Slight cold stress	Cool
9 – 26	No thermal stress	Comfortable
26 – 32	Moderate heat stress	Warm
32 – 38	Strong heat stress	Hot
38 – 46	Very strong heat stress	Very hot

(3) Thermal Sensation Votes (TSV) is an index that predicts the thermal sensation scale that is based on the balance of heat within the human body. Air temperature, relative humidity and average radiant temperature have positive effects on thermal sensation.

Thermal perception	ASHRAE TSV 7-Points Scale
Cold	- 3
Cold	- 2
Slightly cold	- 1
Neutral	0
Slightly warm	+ 1
Warm	+ 2
Hot	+ 3

References

- [A comparative analysis of human thermal conditions in outdoor urban spaces in the summer season in Singapore and Changsha, China \(researchgate.net\)](#)
- *Tools for cooling Singapore - A guide of 24 simulation tools to assess urban heat island and outdoor thermal comfort.* <https://www.research-collection.ethz.ch/handle/20.500.11850/428031>
- [Improving Outdoor Thermal Comfort in Singapore by Implementing Green Mitigation Strategies: A Sensitivity Analysis \(researchgate.net\)](#)

RE1.2b Urban Heat Island Mitigation

Urban Heat Island (UHI) effect is a phenomenon whereby urban areas become warmer than the surrounding natural areas. The major causes of the UHI effect includes:

- Heat release resulting from energy consumption
- Heat storage effect of construction materials such as concrete and asphalt
- Reduced evaporation from land surface due to less green areas and water spaces
- Heat stagnation due to densely packed buildings

Urban heat island effects can have adverse impacts on (a) the environment i.e. deterioration of outdoor air quality, deterioration of indoor air quality, increase in energy demand, and (b) health i.e. periods of high temperatures can cause heat stress, discomfort, heat stroke, respiratory problems, etc. To mitigate UHI effects, buildings can adopt measures to combat these adverse impacts.

Assessment Criteria

RE1.2b Urban Heat Island Mitigation	New Buildings	Existing Buildings
<p>Adoption of UHI mitigation measures such as:</p> <ul style="list-style-type: none"> • Green and blue spaces for landscaping and roof • Roofing materials or coatings or cool paints with high Solar Reflectance Index (SRI) > 40 • Unshaded hardscape areas with SRI > 39, inclusive of unshaded carparks, internal roads, plazas, and pedestrian walkways • Use of permeable paving strategies such as gravel or open paving systems. • Other performance-based strategies that demonstrate UHI effect mitigation. <p>The site plan shall be used to calculate the site coverage, at plan view, of mitigation measures adopted.</p>	<p>1 Point</p> <p>0.5 Point for ≥ 50% site coverage,</p> <p>1 Point for ≥ 80% site coverage</p>	<p>1 Point</p> <p>0.5 Point for ≥ 50% site coverage,</p> <p>1 Point for 80% site coverage</p>

Documentation Requirements

Submission of the following where applicable:

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- a) Site plan highlighting vegetation and waterbody areas, hardscape areas and roof areas
- b) Calculation of hardscape areas shaded by vegetation based on a midday sun i.e. the shadow shall correspond to the area directly under the tree canopies. The tree canopy size shall be based on the mature crown size as per NParks guidelines.
- c) Material schedules or specifications of the roof and hardscape finishes with corresponding SRI values. Where such values are not provided, calculations in accordance to ASTM E1980 – 11 may be used supported by solar reflectance and thermal emittance specifications

At Verification stage (New Buildings & Existing Buildings):

- a) Any design changes to be highlighted on the plan drawing and the areas recalculated
- b) Photographic evidences of the vegetated areas
- c) Delivery orders of the hardscape materials and roof finishes supported by technical specifications providing the SRI or solar reflectance and thermal emittance values

Guidance Notes

The sample calculation shall be submitted together with the site plan showing the affected areas:

Areas	Greenery Area (m2)	Permeable Paver (m2)	Metal Roof (m2)	Remarks
Level-1	967	2,323	-	
Level-4	50	-	-	
Level-5	213	-	-	
Lower Roof	495	-	-	
Upper Roof	656	-	5,312	Metal roof SRI=70
Total	2,381	2,323	5,312	

UHI mitigation area (m2)	10,017	
Site Area (m2)	11,536	
% Site Coverage of UHI mitigation	81.14 %	(≥ 80%, 1 point)

To mitigate the UHI effect, building owners can consider the following measures:

- Increasing greenery provisions in the built environment in the form of rooftop gardens, vertical landscaping as well as neighbourhood parks.
- Create shade by planting trees and shrubs on the western and southern sides where solar radiation is most intense.
- Application of light-coloured paints to exterior walls.
- Use of solar photovoltaic panels on roof which also provides shading
- Use of reflective roofing materials and building materials which absorb less heat. Reflective roofs have high Solar Reflectance properties (SR) i.e. the ability to reflect energy and Infrared Emittance (IR) properties which is the ability to release absorbed energy.
- Metal roofing materials can achieve solar reflectance of over 70%. Reflected solar energy allows the roof surface to remain cooler, which means less heat is transferred into the building, which reduces contribution to the UHI effect.
- Use of permeable pavement such as gravel pavers. The UHI effect is mitigated by allowing water and air to circulate throughout the 'paving' material, cooling the surface and allowing for less heat absorption than traditional concrete.
- Effective use of prevailing wind directions and orientation of buildings.
- Implement energy savings measures that reduce the heat released into the atmosphere and alleviate global warming.

References

ASTM E1980 -11 (2001) 'Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces'; ASTM International

URA, Skyline Issue 10, Ways to beat the heat: <https://www.ura.gov.sg/Corporate/Resources/Publications/Skyline/Skyline-Issue10/Beat-the-heat>

RE1.3 Contextual Response

To achieve an optimal design, the design team shall identify the relationship between human and physical geography of the site. This is done by performing site analysis/simulations on the urban context, site topography, site microclimate, site access and connectivity.

Assessment Criteria

RE1.3 Contextual Response	New Buildings	Existing Buildings
To demonstrate how the site topography, microclimate, access and connectivity has informed the design of the urban form and site layout. A site analysis should be conducted to identify the relationships between human and physical geography of the site and inform how the building responds to these factors.	2 Points	N/A

Documentation Requirements

At Design stage (New Buildings):

A site analysis report that demonstrates the development of the building design based on analysis on the response to the urban grain, site connectivity and access, microclimate and locations of amenities and opportunities for green corridors.

Guidance Notes

As a guide, the site analysis report shall include but not limited to the following contents:

- 1) Executive Summary – A non-technical summary that summarises the site analysis
- 2) Urban context – The urban form, land use and its impact on the site. This shall include key vistas, view corridors, the urban grain as well nearby amenities
- 3) Site Topography & Hydrology – Land and topographical survey of the site facilitating design decisions based on the site’s topographical features, storm water runoff and other key features.
- 4) Site Microclimate - Sun/ Wind/ Acoustics/ Views/ Air Quality:
 - a) Identification on plan and photographic evidence of the key microclimatic conditions of the site and how this will be considered in the design
 - b) Macro level simulations such as wind analysis to capture prevailing winds and mitigate stagnant air flow areas, solar analysis for the proposed design to reduce solar heat gains and solar glare, solar simulation that analyse the site context
- 5) Site Access and Connectivity – Details of pedestrian and vehicular traffic, site accessibility and public transport options. The analysis shall investigate the connectivity potential to connect the site to existing green infrastructure such as parks, gardens or cycle routes, as well as sheltered connectivity to public transport. The analysis should also look at physical connectivity feasibility to adjacent buildings (existing or planned) and demonstrates how the functional requirements of the project responds positively to the site context including enhancing site access.
- 6) Massing Studies – Iterative massing studies through macro simulations that identify how the urban form of the building has been optimised, the location of outdoor amenities has been located to take advantage of the site conditions, including outdoor thermal comfort analysis. The simulations should identify that the building minimises its impact on its neighbours.

- 7) Natural Ventilation Simulation – Analysis may include Computational Fluid Dynamics Simulations (CFD) to achieve good ventilation in the development. CFD can be carried out to optimize facade design to allow maximum natural ventilation for the different parts of the building.
- 8) Traffic Impact Analysis – This analysis can be conducted throughout the design phases of the development to ensure that there are minimal or no impacts on its neighbours while ensuring that traffic continues to operate both safely and efficiently.
- 9) Conclusion – Through the various site analysis, the design team have a better understanding of the existing physical and geographical context of the surrounding areas; including the opportunities and problems, which provides critical design considerations and decisions.

RE2 Manage

A maximum of 5 points can be scored across RE 2 Manage section.

RE2.1a Project Team

It is important to appoint environmental specialists, facility management team and consultants who have the professional knowledge and ability to drive and coordinate the design, construction, operation and retrofit of sustainable and environmentally friendly buildings.

Assessment Criteria

RE2.1a Project Team	New	Existing
(i) Accredited professionals: GM AP / GM AAP GM AP(FM) / GM AAP(FM)	0.5 Point (max) [GM AP = 0.25 Point GM AAP = 0.5 Point]	1 Point (max) [GM AP(FM) = 0.5 Point GM AAP(FM) = 1 Point]
(ii) Firms certified under Singapore Green Building Services (SGBS) certification scheme and Certified FM Company (CFMC) accreditation scheme	0.5 Point (max) [1 firm = 0.25 Point]	0.5 Point (max) [1 firm = 0.25 Point]

For New Buildings, points shall be awarded for qualified environmental specialists who demonstrated contribution in the design and construction of the project and demonstrated involvement in Green Mark assessment.

For Existing Buildings, points shall be awarded for qualified in-house building and facility management team or environmental specialists in the sustainable operation of the building and demonstrated contribution and involvement in Green Mark assessment and verification.

Points will also be awarded for firms providing certified services under Singapore Green Building Services (SGBS) certification scheme by SGBC and Certified FM Company (CFMC) accreditation scheme by Singapore International Facility Management Association (SIFMA).

Documentation Requirements

For New Buildings, there must be evidence of involvement by the environmental specialists via submission of relevant valid certificates for GM AP / GM AAP issued by SGBC Green Mark Accredited Professional Scheme, notes of meetings, letters of appointment, as well as commitment letter endorsed by client on appointment intent, if applicable.

For Existing Buildings, there must be evidence of involvement by the environmental specialists in the Green Mark assessment or verification via submission of relevant valid certificates of Green Mark AP (FM) or Green Mark AAP (FM) issued by SGBC Green Mark Accredited Professional Scheme.

For firms under Singapore Green Building Services (SGBS) and/or Certified FM Company (CFMC), submission of relevant valid certification issued by SGBC or SIFMA is required.

References

- Singapore Green Building Services (SGBS) certification scheme: <https://web.sgbc.online/public/service/>
- Certified FM Company (CFMC) accreditation scheme: <https://singaporesifma.com/CFMC>

RE2.1b Procurement

(i) Sustainable Procurement Policy

To implement green procurement of environmentally sustainable products and materials, and green services in order to minimise environmental impacts and promote sustainable design, operations and maintenance within the building.

Assessment Criteria

RE2.1b Procurement	New Buildings	Existing Buildings
(i) Sustainable procurement policy including commitment to procuring accredited or labelled green services, utilities, venues, products and systems related to the building operations and business activities.	<u>For Non-Residential Buildings</u> 1 Point <u>For Residential Buildings</u> 0.5 Point for 1 st year operation under developer's control.	<u>For Non-Residential Buildings</u> 1 Point <u>For Residential Buildings</u> 1.5 Points for MCST procurement of replacement common area systems, and AGM venues

Points shall be awarded for the adoption and implementation of a Green Procurement Policy, which is a written document endorsed by the top management, stating the commitment towards procuring the following:

- green products, materials and services certified by an approved local certification body; and
- green products, materials, goods and services from contractors and vendors committed to environmental sustainability.

Documentation Requirements

For New Non-Residential Buildings – A draft Green Procurement Policy and extracts of tender specification and drawings showing the requirements to incorporate green products certified by an approved local certification body i.e. Singapore Green Building Council (SGBC) or Singapore Environment Council (SEC).

For New Residential Buildings – A draft Green Procurement Policy to be submitted by **the developer for the 1st year operation**; and extracts of tender specification and drawings showing the requirements to incorporate green products certified by an approved local certification body i.e. SGBC or SEC.

For Existing Non-Residential Buildings – An official Green Procurement Policy endorsed by **top management from building owner**; and evidence of purchase or quotation for the green products and services certified by an approved local certification body i.e. SGBC or SEC.

For Existing Residential Buildings – An official Green Procurement Policy endorsed by **MCST for the procurement of products and services in the common areas/system and AGM venues**; and evidence of purchase or quotation for the green products and services certified by an approved local certification body i.e. SGBC or SEC.

Examples of other green procurement practices within the Green Procurement Policy, where applicable:

- to procure green vehicles fleets
- to procure green hotels for events i.e. certified Green Mark hotels and convention centres
- to work with suppliers to deliver goods without or less disposable packaging
- to use products with less packaging
- to use non-disposables for dine-in
- to choose non-disposables or reusable crockery and cutlery when catering food
- to provide water jugs and reusable cups for meetings
- to choose biodegradable products where possible
- to choose green electricity plans for utilities

The commitment would depend on what is under the building owners’ control (e.g. owner occupied or part of green leasing requirements). For tenanted buildings, the green procurement practices shall be incorporated in the Lease Agreement.

(ii) Energy Performance Contract

To implement a performance-based procurement through an Energy Performance Contracting (EPC) firm to provide services that guarantees operational system efficiency for a minimum of 3 years.

Assessment Criteria

RE2.1b Procurement	New	Existing
<p>(ii) Energy performance contracting to implement and deliver energy efficiency, renewable energy and/or energy recovery project with an energy performance contract wherein the EPC firm’s remuneration is based on demonstrated energy savings or maintained efficiency levels.</p>	<p><u>For Non-Residential Buildings</u> 1 Point</p> <p><u>For Residential Buildings</u> N/A</p>	<p><u>For Non-Residential Buildings</u> 1 Point</p> <p><u>For Residential Buildings</u> N/A</p>

Points shall be awarded when building owner or developer engages an SGBC Accredited Energy Performance Contracting (EPC) firm or equivalent to implement and deliver energy efficiency, renewable energy and/or energy recovery project with an energy performance contract wherein the EPC firm’s remuneration is based on demonstrated energy savings.

The EPC firm shall guarantee operational system efficiency over a minimum of 3 years and provide one or more of these services:

- provision of energy efficient technology and services including financing, design, implementation and management of projects
- supply, installation and commissioning of cooling and/or heat-recovery systems
- supply, installation and commissioning of air distribution system
- supply, installation and commissioning of CHP or tri-gen power generation
- supply, installation and commissioning of solar PV or thermal systems
- solar leasing
- M&E contracting

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Submission of extracts of the tender documentation to include the project deliverables, financial model and duration of performance contract.
- A copy of the certificate of EPC accreditation by SGBC or equivalent

At Verification stage (New Buildings & Existing Buildings):

- Extracts of the EPC signed between building owner and an EPC firm including details of the guaranteed performances and duration of the performance contract
- Verification report showing the operating efficiencies of the guaranteed system

References

Singapore Green Building Services (SGBS) Directory: <https://web.sgbc.online/public/service/>

RE2.2 Circularity

We need to adopt a circular economy approach to keep valued resources in use for as long as possible. Aligned with the focus areas under Singapore’s Zero Waste Masterplan, buildings can enhance waste management strategies to tackle the 3 priority waste streams – E-waste, Packaging waste and Food waste, by adopting a circular economic approach to close resource loops.

RE2.2 Circularity	New Buildings	Existing Buildings
Tackling the 3 priority waste streams and adopting a circular economic approach to close resource loops.	(Cap at 1 Point)	
i. Provision of dedicated recycling facilities and receptacles at convenient and accessible locations for <ol style="list-style-type: none"> E-waste in collaboration with the Producer Responsibility Scheme (PRS) Operator, and Packaging waste including used beverage containers 	0.5 Point	0.5 Point
ii. Food waste systems for proper segregation (as detailed within the food waste segregation requirements under the <u>Resource Sustainability Act</u>), pre-treatment (such as grinding) and on-site treatment, <u>or</u> direct conveyance for off-site treatment.	0.5 Point	1 Point
iii. Waste audits and engagement <ol style="list-style-type: none"> Annual waste audits to identify areas of wastage, and uncover opportunities to reduce, reuse or recycle waste materials Provide waste management/3R training/education for staff/tenants and cleaners at least twice a year. 	0.5 Point for (iii)	1 Point for (iii)

(i) Provision of Dedicated Recycling Facilities and Receptacles for E-waste and Packaging Waste

Recognising projects that design operational waste management plans to facilitate recycling of priority waste streams such as e-waste and packaging waste.

Assessment Criteria

Points shall be awarded for the provision of facilities and receptacles for the collection and storage of **E-waste** for consumer products (e.g. ICT equipment, appliances, lamps, batteries) in collaboration with the Producer Responsibility Scheme (PRS) operator.

Points shall be awarded for the provision of facilities and receptacles for the collection and storage of **Packaging waste** including used beverage containers, such as tetra paks, plastic bottles and aluminium cans, dry food packaging and containers, cardboard packaging etc.

Note: Points shall not be awarded for premises mandated to provide recycling facilities under the Resource Sustainability Act or other development requirements.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Relevant layout plans showing the provision of the recycling facilities for collection and storage of the relevant recyclables.

At Verification stage (New Buildings & Existing Buildings):

- On-site photos showing the provision of the recycling facilities for collection and storage of the relevant recyclables.
- E-waste: Valid documentation showing collaboration with PRS Operator
- Packaging Waste: Valid documentation showing collaboration with waste collection vendor for collection of recyclables

Guidance Notes

The recycling facilities or systems provided should be applicable to the building type and level of occupancy. It should also be placed in a location convenient for building users, or close to the expected source of waste generation.

Please refer to the following websites for more information on

- E-waste and Packaging Waste - [Resource Sustainability Act](#) by Ministry of Sustainability and Environment (MSE)
- [Producer Responsibility Scheme Operator for E-waste Management](#) by National Environment Agency (NEA)

(ii) Provision of Food Waste Systems with Proper Segregation and Treatment

Recognising projects that design operational waste management plans for proper segregation of food waste to reduce contamination of recyclables and allow for greater resource recovery and to divert food waste for on-site or off-site treatment.

Assessment Criteria

Points shall be awarded for the provision of food waste systems with proper segregation, pre-treatment (such as grinding) and on-site treatment, or direct conveyance for off-site treatment. Proper and sanitary collection and storage facilities and receptacles must be provided during various handling stages of food waste.

Note: Points shall not be awarded for premises mandated to provide recycling facilities under the Resource Sustainability Act or other development requirements.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Relevant layout and waste management plans showing the provision of proper and sanitary collection and storage of food waste, during segregation, pre-treatment and on-site treatment or direct conveyance for off-site treatment.

At Verification stage (New Buildings & Existing Buildings):

- On-site photos showing the provision of the proper and sanitary collection and storage of food waste, during segregation, pre-treatment and on-site treatment or direct conveyance for off-site treatment.
- For On-site treatment: Valid documentation or pictures showing on-site treatment facilities and use of food waste products
- For Off-site treatment: Valid documentation or records on collaboration with food waste vendor for off-site treatment

Guidance Notes

The recycling facilities or systems provided should be applicable to the building type and level of occupancy. The food waste recycling facilities or systems should also be placed in a location convenient for the team managing and operating the systems, and close to the expected source of food waste generation.

Please refer to the following websites for more information on

- Types of premises and corresponding thresholds for mandatory food waste segregation for treatment under Annex F of [Resource Sustainability Act](#) by Ministry of Sustainability and Environment (MSE)
- Strategies for [Food Waste Management](#) by National Environment Agency (NEA)

(iii) Waste Audits and Engagement

Buildings that conduct annual waste audits can better understand their waste profile to identify areas of wastage and uncover opportunities to reduce, reuse or recycle waste materials. Engagement with building occupants such as staff, tenants and other end-users can help to raise awareness on the 3Rs of waste management (reduce, reuse, recycle) and change wasteful practices and behaviours. Buildings can also monitor waste outputs over time to measure effectiveness of waste management programmes.

Assessment Criteria

Points shall be awarded for waste audits conducted annually and waste management/3R training/education provided for staff/tenants and cleaners at least twice a year.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Relevant waste management plans and commitment to conduct a waste audit annually and provide waste management/3R training/education provided for staff/tenants and cleaners at least twice a year

At Verification stage (New Buildings & Existing Buildings):

A waste audit is a structured process of identifying and quantifying the sources, amount and types of waste being generated in the premise. The waste audit would profile the waste types in the premise by indicating data on:

- types of waste,
- quantity of each waste type,
- how they are generated,
- why they are generated,
- where they are being generated, and
- how they are managed after being generated.

The audit report should also include an analysis on the opportunities for 3R initiatives and recommendations on improvements for waste management.

For engagement, the documentary evidences required include:

- Educational posters, emails or programmes that promote the 3Rs for waste management among staff/tenants/building occupants and visitors, and
- Notices of 3R training sessions, photographs and materials used for 3R training sessions conducted for staff/tenants and cleaners, that demonstrates training had been conducted at least twice a year

Guidance Notes

The waste audit can be done in-house by the facilities management team or by relevant third parties, such as the premises' general waste collector or waste management consultants. For more information on guidelines on how a waste audit is conducted, please refer to NEA's [3R Guidebooks](#) for premises such as hotels, shopping malls, offices, schools and industrial developments.

RE2.3 Resilience Strategy

As the threat of climate change looms larger, growing frequency in extreme weather events, changes in public concerns, policies and regulations pose significant physical and transition risks for organisations and countries. The built environment consumes over a third of the world's natural resources and produces around 40 per cent of global carbon emissions. To aggressively lower our built environment's carbon emissions and build climate-resilient and environmentally friendly buildings, the sector should consider and integrate climate change risks and adaptation in their business strategy and operationalise into effective action for climate resilience.

Provision of comprehensive project-specific climate change risk and adaptation assessment

Many view the potential impacts of climate change as physical and occur in the long term and, thus, not relevant to decisions made today. As nations make shifts towards a lower-carbon economy, this transition will impact businesses and their operations to present both significant risks and opportunities. For the built environment, reviewing the physical and transition related risks faced by buildings/assets through scenario analysis can help developers/building owners to identify opportunities for adaptation and develop timely strategies to strengthen business and asset resilience to climate change.

Assessment Criteria

RE2.3 Resilience Strategy	New Buildings	Existing Buildings
A comprehensive <i>project specific</i> climate change risk and adaptation assessment, aligned to principles outlined by the Taskforce for Climate Related Financial Disclosures (TCFD), that:		
i. Use various climate scenarios and impact on weather, including rainfall, temperature, sea level rise, flooding, drought and public health pandemics, to assess project's climate-related physical and transition risks and opportunities;	2 Points	2 Points
ii. Conceptualise clear environmental sustainability targets and design approaches early at the onset of the project to be included in project brief to manage identified risks; or	1 Point	N/A
iii. Develop an action plan that addresses how the building would be resilient to these events, through current or future design interventions.	N/A	1 Point

Documentation Requirements

(i) Scenario Analysis for assessment of climate-related risks and opportunities

Written reports or documents demonstrating assessment of climate-related risks and opportunities using scenario analysis conducted for project site.

- Identify and understand the building's exposure to climate-related physical¹ and transition² risks
 - What is the potential climate-related physical and transition risks facing the building?
Potential risks and impacts from climate change include, but not limited to:
 - Direct damage or failure of building components
 - Accelerated deterioration of building components or reduced design life
 - Reduced operating capacity
 - Impacting access and egress to building's surrounding areas
 - Impacts to health and wellbeing of building occupants and relevant stakeholders
 - Indirect risks from impacts to other interdependent systems and services (e.g. power, water, telecommunications, transport networks)
 - Indirect nature-related financial and business risks derived from biodiversity loss or changes, if applicable
 - What is the organisation's opinion of climate change and the potential climate-related risks faced?
- Assess materiality of climate-related risks and potential consequent impact on building operations, businesses, and strategies over time
 - What are the key drivers/metrics of the building/asset performance? E.g. energy performance, maintenance costs, rental revenue etc.
 - What are the current and anticipated exposures faced by the building/asset? Note that historic data and future projections should be used when identifying project's exposure to climate-related risks.
 - Do the risks identified have potential to be material in the future?
 - Are the building/organisational stakeholders concerned?
 - Are there any compliance requirements or obligations under local/regional/international law with respect to climate-related risks?
- Identify and define range of scenarios/narratives appropriate for the building/asset, given the exposures
 - Consider at least 2 suitable future climate change scenarios for assessment (e.g. 2°C, 4°C, based on Intergovernmental Panel on Climate Change (IPCC) endorsed emissions scenarios)
 - Identify relevant input parameters, assumptions and analytical choices, to the geographical location and operations of building/asset within these transition scenarios.
 - Relevant variables such as temperature, extreme temperature, rainfall, extreme rainfall/flooding, storms, wind, humidity, bushfires, solar radiation, sea level rise, ocean acidification etc.
 - Project team must assess scenarios using timescales of 2050 as minimum.
- Evaluate risks and impacts on building operations, businesses, and strategies over time, using key drivers/metrics identified, under each defined scenario for the building/asset
 - Define the risk assessment criteria applied and include the consequence/impact and likelihood tables and risk matrix used to assess climate-related risks
 - A summary of priority risks (high likelihood and high impact) for treatment and those risks rated high or above certain threshold to be highlighted and captured as part of project's risk register
 - Risks must be assessed in consultation with multidisciplinary representatives of the project team and with relevant external stakeholders of the building

¹ Physical risks refer to risks related to the physical impacts of climate change that are event driven (acute) such as hurricanes or floods, or longer-term shifts (chronic) such as sea level rise or chronic heat waves, with potential financial implications for organisations i.e. direct damage to assets and indirect impacts from supply chain disruption.

² Transition risks refer to risks related to the transition to a lower-carbon economy such as extensive policy, legal, technology and market changes to address mitigation and adaption requirements related to climate change. Transition risks may pose varying levels of financial and reputational risk to organizations depending on the nature, speed, and focus of these changes.

- Identify potential responses and opportunities for adaptation, where relevant
 - What are some actions to respond to the climate-related risks identified?
 - Assessment must develop adaptation responses for all priority risks
 - Adaptation responses should include a range of physical (or design) (e.g. structural design changes) and non-physical (e.g. monitoring and measurement, management strategies) responses
 - What are those actions that are realistic and can be applied in the short term, mid-term and long-term?
 - Identify and document the timeframes for undertaking regular reviews and updates
 - What adjustments to building/business operations, strategies or plans would be required?

Useful information/links:

- [Technical Supplement – The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities](#). See page 6 for risks and opportunities, page 8 and 9 for key considerations for Scenario Analysis, and page 12 to 29 for information on International Energy Agency (IEA) and IPCC Climate Scenarios
- [Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures](#). See page 60 and 61 for illustrative examples of key metrics related to the Built Environment Sector
- Examples: [Lendlease – TCFD Progress](#), [GRESB – TCFD Reporting](#)
- Climate Data: [Intergovernmental Panel on Climate Change \(IPCC\) scenarios](#), [Singapore’s Climate Information and Data](#)
- [Singapore’s Climate Action Plan: A Climate-Resilient Singapore, For a Sustainable Future](#) See page 5 for future projections on Singapore’s climate, page 8 for examples of risks Singapore faces, and page 30 and 31 for a summary of adaptation efforts

(ii) Environmental sustainability targets and design approaches in project brief to mitigate climate-related risks [For New Developments]

Written statements, reports or documents that demonstrate the project’s consideration in design approaches to mitigate climate-related risks and define clear environmental sustainability targets. This project brief must be endorsed by the building owner/client or building owner/client’s representative and acknowledged by the key project team members. The documentary evidences shall provide details on:

- Strategic Definition of Design Approach
 - Demonstrate how the potential climate-related risks faced by the project has been considered in the design approach
 - Include feasibility studies involving assessments of options against functional requirements and potential constraints to rationalise the brief.
- Target Setting of Environmental Sustainability Outcomes
 - Identify what the building owner/client’s sustainable aspirations are for the project
 - Identify the green potential of the project when benchmarked against similar projects (i.e. building type, scale of project, scope of works)
 - Setting of agreed achievable formal sustainability targets/outcomes for the project. In addition to the project’s targeted Green Mark rating, such targets should involve specific sustainable outcomes and indicators.
 - The plans and considerations for the selection, deployment and responsibilities of the project team, builders and building operators in order to ensure an optimised building should be detailed. This includes the identification of at least one member of the project team to take the lead in coordinating sustainability efforts and tracking of the targets throughout the building design, construction and handover phase.

References:

- [Singapore Institute of Architects \(2020\) ‘The SIA Green Book: Sustainability at the Heart of Practice’, SIA Publishing](#)
- [Bahar, U. \(2020\) ‘How to Use RIBA 2020 Plan of Work: RIBA Design Stages Explained’](#)
- [Royal Institute of British Architects \(2020\) ‘RIBA Plan of Work 2020’, RIBA Publishing](#)

(iii) Action plan to be climate-resilient through current or future design and operational interventions [For Existing Buildings]

Written statements, reports or documents that details the project’s action plan to be climate-resilient through current or future design and operational interventions. This action plan must be endorsed by the building owner/client or building owner/client’s representative and acknowledged by the management team. The action plan should

- Identify indicators, targets or outcomes that demonstrate the project’s climate resilience (end-state), as relevant for the project for the next 5 years
- Indicate the timeframes for undertaking regular reviews and updates
- Identify suitable and cost-effective design and operational improvements and demonstrate how the identified measures will address and alleviate the potential climate-related risks faced by the project
- Illustrate methods and frequency on monitoring, benchmarking and reporting of the indicators, targets or outcomes and measures implemented on site in the next 5 years.

Guidance Notes

The comprehensive project-specific climate change risk and adaptation assessment should be undertaken as early during the project’s design phase as possible to maximise benefit and opportunity to inform design decisions and implement appropriate and meaningful adaption responses.

A suitably qualified professional with experience in climate change risk and adaptation assessments should author and conduct the assessment for the project.

In addition to the adaptation responses and opportunities uncovered at the base building level, projects should also consider the implications and opportunities to improve resilience of building for tenant/occupant use. Building resilience should involve the entire community, including individuals and businesses, with everyone playing a role.

Additional non-physical adaptation responses, including emergency management plans or information to manage extreme climate events (i.e. tips on using sun-shading measures to reduce thermal load, flooding procedures in event of storms) can be communicated to tenants/occupants. Private enterprises should review business continuity plans to cater for disruptions caused by extreme weather events. Everyone also needs to be mentally prepared for a changing environment.

Task Force on Climate-related Financial Disclosures (TCFD) and Key Recommendations

The Financial Stability Board established the industry-led Task Force on Climate-related Financial Disclosures (TCFD) with the aim of increasing the transparency, relevance and utility of climate-related disclosures by organisations. The Task Force developed key recommendations to help appropriately assess climate-related risks and opportunities that are applicable to organizations across sectors and jurisdictions.

With climate-related risks becoming increasingly recognized as important factors for consideration in economic decision-making and strategic planning, more global standards setting bodies, financial institutions and regulatory authorities are supporting TCFD recommendations for climate-related reporting. More information on TCFD can be found at <https://www.tcfhub.org/recommendations/>.

RE3 Restore

A maximum of 5 points can be scored across RE 3 Restore section.

RE3.1 Buildings in Nature

Buildings that incorporate a well-considered landscape and planting strategy and approach can help to improve the ecology and quality of the natural environment on site. Restoring nature in our urban landscape by having more greenery around and within the development can help to mitigate urban heat island effect resulting in cooler temperatures, provide visual relief to building occupants and neighbours, and enhance the native biodiversity in our urban landscape to enrich our living environment.

(i) High GnPR

The Green Plot Ratio (GnPR) is a calculation of greenery provision that demonstrates the total leaf area of the greenery within the site over the total site area. The greenery applicable includes trees, palms, shrubs, turf, community gardens/farms, rooftop gardens/sky terraces and vertical greenery on building facade.

Assessment Criteria

RE3.1 Buildings in Nature	New Buildings	Existing Buildings
(i) High GnPR (>5 for New Developments, >3 for Existing Buildings)	1 Point	1 Point

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Plan layouts or software showing the site area and greenery that is provided within the development
- Provide a comprehensive listing of the number/area covered by the greenery applicable (i.e. trees, palms, shrubs, turf [including community gardens/farms] and vertical greenery)
- Calculations of GnPR to show the extent of the greenery provision on-site. A worked example is available in the Guidance Notes.

At Verification stage (New Buildings & Existing Buildings):

- As built drawings showing the landscape plans with the delivery orders of the plants.
- Re-computation of GnPR for any deviations using the GnPR calculation template
- Develop a landscape maintenance and management plan for building operation

The submission of documentation required is listed above, where applicable.

Guidance Notes

Worked Example on Calculation of the Greenery Provision (GnPR)

- Determine the number of trees, palms and the areas for shrub and turfs and other greenery areas.
- The Leaf Area Index values and Canopy Area are pre-determined parameters applicable for all developments.
- Compute the GnPR as shown in the Table below.

Category	Sub-Category	Leaf Area Index (LAI) Value	Canopy Area /m ²	Quantity/ Planted Area		Leaf Area
		(A)	(B)	(C)		(A) x (B) x (C)
Trees	Open Canopy	2.5	60	40	no	6000
	Intermediate Canopy	3	60	25	no	4500
	Dense Canopy	4	60	0	no	0
	Intermediate columnar canopy	3	12	0	no	0
Trees	Planted ≤ 2.0m trunk to trunk	As above	NA	0	m ²	0
Palms	Solitary	2.5	20	32	no	1600
	Cluster	4	17	10	no	680
	Solitary (trunk to trunk ≤2m)	2.5	NA	12	m ²	0
Shrubs	Monocot	3.5	NA	120	m ²	420
	Dicot	4.5	NA	470	m ²	2115
Turf	Turf (including community gardens/farms)	2	NA	820	m ²	1640
Vertical Greenery	(i.e. creepers/ climbers/vines)	2	NA	120	m ²	240
Total Leaf Area (m ²)						17195
Total Site Area (m ²)						5200
GnPR (Total Leaf Area ÷ Total Site Area)						3.31

(ii) Diverse Range of Plant Species

The project site provides a diverse landscape and prioritises the of indigenous plants that contributes to the conservation and maintenance of local habitats and ecosystem for long-term sustainability.

Assessment Criteria

RE3.1 Buildings in Nature	New	Existing
(ii) Diverse range of plant species - of which 50% shall be native to Southeast Asia	1 Point	1 Point

A diverse range of plant species should be adopted where no more than 25% of species (coverage by Leaf Area) to be the same. No invasive species are allowed. A minimum GnPR of 3.0 for new developments and GnPR of 2.0 for existing buildings is required for scoring.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Landscape plan outlining the native species with a calculation of the % of species coverage by Leaf Area.

At Verification stage (New Buildings & Existing Buildings):

- Delivery orders of the native species and quantity to be prepared and submitted. Any variations would require a re-tabulation
- Develop a landscape maintenance and management plan for building operation

(iii) Provision of 'Wild Landscape Areas' to Provide Habitat for Local Species

Habitat conservation, creation, enhancement and restoration will benefit the conservation of native biodiversity including species protection and recovery to reduce the rate of biodiversity loss. Habitat restoration can also strengthen natural protection against extreme weather events that increases risk of flooding.

Assessment Criteria

RE3.1 Buildings in Nature	New Buildings	Existing Buildings
(iii) Provision of 'Wild landscape areas' (10% of site area) to create habitat pockets on the site	1 Point	1 Point

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Landscape plan outlining the habitats conserved, created, enhanced or restored with a calculation of the percentage of site coverage
- Provide details on how the choice of landscaping and biodiversity and/or enhancements made form suitable and self-sustaining habitats for local species and increase resilience of the landscape.

At Verification stage (New Buildings & Existing Buildings):

- Purchase or Delivery orders of the plants species and quantity to be submitted.
- Photographic evidence of habitats conserved, created, enhanced or restored

Guidance Notes

The landscape areas should emulate native landscapes, reflecting the composition, density and function of local habitats or conserve existing habitats, e.g. having varying canopy heights, species selection that are known to encourage bird nesting, increasing food plants variety, features to link different landscape areas.

The areas should be well integrated with the urban landscape with minimal maintenance required of the natural space., for example allowing grasses to grow. The landscape areas should also enhance ecological connectivity to facilitate the movement of biodiversity and exchange of genetic material, leading to healthier populations.

Other examples and planting design considerations for enhancing existing habitats include grasslands, riverine, dragonfly ponds, planting butterfly-attracting shrubs, bee trails etc.

Please refer to the following websites for more information on

- *Plant classifications and foliar information such as Leaf Area Index (LAI) value at <https://www.nparks.gov.sg/florafaunaweb/>*
- [*Landscaping for Urban Spaces and High-rises \(LUSH\) programme*](#)
- [*LUSH 3.0 such as minimum GnPR requirements for developments providing Landscape Replacement Areas*](#)
- [*NParks Landscape Excellence Assessment Framework \(LEAF\) for key considerations on good landscape design, construction and management of parks and development projects*](#)

RE3.2 Natural Climate Solutions

Natural Climate Solutions (NCS), or Nature-based solutions (NBS) refer to ways that harness natural processes to reduce or remove greenhouse gases (GHG) for climate mitigation and to increase capacity for climate adaptation. Today, ecosystems like forests, mangroves, peatlands, lakes and rivers, oceans and coasts mitigate a significant portion of anthropogenic GHG emissions, with approximately a quarter is absorbed by trees, plants and soil, and another quarter by marine systems³.

Given the pressing need to decarbonise, solutions such as carbon capture and storage technologies and renewable energy alone will not be enough to attain carbon neutrality. Restoration and conservation of our natural carbon sinks is a critical pathway on our route to decarbonisation. Currently, with less than 3% of global climate finance goes to natural climate solution⁴, we will need new public-private sector partnerships and longer-term financial commitments from all parties to enable and incentivise protection and restoration of our ecosystems.

(i) Restoration of Ecology through Reforestation and Marine/Aquatic Ecosystem Restoration Programmes

The development has considered its impacts to nature and undertaken measures to restore natural ecosystems beyond its site.

Assessment Criteria

RE3.2 Natural Climate Solutions	New Buildings	Existing Buildings
(i) Restoration of ecology equivalent to the GFA of the development through either, or a combination of: <ul style="list-style-type: none"> a. Reforestation programme b. Marine/ Aquatic ecosystem restoration programme (such as mangrove forests, seagrass beds, salt marshes, coral propagation) With a 10-year commitment to investment and/ or management	2 Points	2 Points

Other programmes that support ecosystem restoration can be considered on a case-by-case basis.

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Not applicable. Measures must be implemented for scoring.

At Verification stage (New Buildings & Existing Buildings):

Written documents such as contractual or official agreements, correspondences between building owner and organisation(s) involved in the restoration programme/project, implementation and management plans etc.

- Identify the involvement of building owner/organisation in the support of the reforestation and/or marine/aquatic ecosystem restoration programme
- Indicate the size of area restored through the ecosystem restoration programmes to be equivalent to the GFA of the development, as verified by an independent third party
- Endorsement from senior management with a 10-year commitment to investment and/ or management of the ecosystem restoration programme

The submission of documentation required is listed above, where applicable.

³ NOAA. (2017). Ocean-Atmosphere CO2 Exchange Dataset | Science On a Sphere. <https://sos.noaa.gov/datasets/ocean-atmosphereco2-exchange/>

⁴ Griscom, B. W., et al. (2017). Natural climate solutions. Proceedings of the National Academy of Sciences, 114(44), 11645–11650. <https://doi.org/10.1073/pnas.1710465114>

Guidance Notes

For tree planting efforts in an urban environment in support of Singapore’s ‘OneMillionTrees’ movement, a conversion ratio of 1 urban tree to approximately 4 m² equivalent of forest restored can be applied, considering the difference in carbon sequestration for urban forestry. The requisite number of trees for the development would need to be planted within the validity period of certification and supporting evidences to show the implementation and management plan for the trees planted.

The nature restoration programmes can be local or overseas programme. The programme should be conducted by a credible organisation and verified by an independent third party.

Useful Links:

- [UNEP Decade on Restoration](#) – More information on ecosystem restoration and restoration initiatives across the globe
- [Blue Carbon Initiatives](#) – More information on coastal and marine ecosystem conservation and restoration programmes
- NParks - [One Million Tree Movement](#), [Garden City Fund](#), [Our National Plan for Conservation](#)

(ii) Investment, Production, or Purchase of Nature-based Credits to Offset Estimated Carbon Impact of Construction/Retrofit and Operation of the Development

Assessment Criteria

RE3.2 Natural Climate Solutions	New Buildings	Existing Buildings
(ii) Investment, production, or purchase of nature-based credits (including blue carbon and REDD+) equivalent to the estimated carbon impact of the construction/retrofit and normal operation of the development over a 10-year period, certified by a recognised third party	2 Points	2 Points

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

- Not applicable. Measures must be implemented for scoring.

At Verification stage (New Buildings & Existing Buildings):

- For the documentation on investment, production, or purchase of nature-based credits, submission of the carbon credit contracts, as certified by a recognised third party and/or relevant contractual documents are required.
- For estimation of carbon impact of construction/retrofit and operation of the development over 10 years, the submission of calculations with supporting documents on figures adopted and details of assumptions made is required.
 - For new developments, the estimated carbon impact needs to include an estimation of embodied carbon of building. Embodied carbon of the development can be computed using the [Singapore Building Carbon Calculator](#).
 - The operation carbon should be estimated from the buildings’ projected consumption over 10-year operations, with suitable assumptions made on project-specific operating conditions and occupancy. All relevant building scope 1 and 2 operational energy related emissions⁵ which are under the direct control or are part of the base building’s scope to be included.
 - Existing buildings should use existing operations as a baseline for projection.

⁵ Scope 1 emissions are defined as direct GHG emissions from sources that are owned or controlled by the company [e.g. vehicles, industrial process loads, backup generators, refrigerants and natural gas]. Scope 2 emissions are defined as indirect GHG emissions from the generation of purchased electricity consumed by the company [e.g. electricity, steam, heating and cooling consumed by the reporting asset].

- For carbon intensity of electricity generation, please refer to local country's Grid Emission Factor (kg CO₂/kWh) for conversion. In 2019, Singapore's average Grid Emissions Factor was 0.4085 kg CO₂/kWh.

Guidance Notes

For more information on

- Examples of carbon offsets programme, please refer to [Blue Carbon Initiative](#) and [REDD+](#).
- Carbon credits trading platforms, please refer to [Climate Impact X](#), [Gold Standard](#), [Verra – Verified Carbon Standard](#), and [United Nations Carbon Offset Platform](#).
- [The Business Case for Natural Climate Solutions – Insights and Opportunities for Southeast Asia](#), a joint report by Temasek, Conservation International, DBS Bank, and National University of Singapore.
- Estimation of embodied carbon, please refer to the 'Whole Life Carbon' section of GM: 2021 on 'Embodied Carbon Computation'.

Resilience - Innovation

Assessment Criteria

Resilience - Innovation	New Buildings	Existing Buildings
Projects can demonstrate substantial performance to a specific Resilience indicator or outcome, where innovation points can be awarded on a case-by-case basis. Points shall be awarded based on the strength of evidence of benefits and potential impact.	2 Points	2 points

Documentation Requirements

At Design stage (New Buildings) / Pre-retrofit stage (Existing Buildings):

The project team is to submit a concise summary that articulates:

- The nature of the environmental benefit of their intervention/innovation
- Justify the impact of the intervention through detailed calculations and comparisons with industry norms
- Substantiate the calculations and comparisons with evidence and data.

At Verification stage (New Buildings & Existing Buildings):

The operations team is to submit:

- Details of the implemented intervention/innovation
- Measurements and recordings of key metrics/indicators to show improvements of environmental performance arising from implemented intervention/innovation
- Lessons learnt if the intervention does not perform as expected

Guidance Notes

Projects can innovate to go above and beyond to attain exceptional Resilience outcomes as intended in one or more criterion or demonstrate unique solutions to enhance other aspects of resilience not specified in the criteria. Innovations will be considered on a case-by-case basis.

Some examples, with reference to the Resilience section criteria, but not limited to, include:

- On RE 2.2, to demonstrate commitment and plans in pushing the boundary of the circularity agenda by piloting or adopting innovative solutions/technologies to close the resource loops and achieve zero waste.
- On RE 3.1, where the project site provides a diverse landscape with more than 80% of plants from native species to Southeast Asia and GnPR of >5.0 for existing buildings
- On RE1 Protect, to adopt bird-safe design and operation strategies in buildings to reduce bird-building collisions and safeguard resident and migratory birds that pass through our island. For example, where the project site is situated close to a green space of >0.5 hectares, all glass panels facing the green space should be treated to mitigate bird-building collisions. More information can be found in NParks' Bird-Safe Building Guidelines.
- On RE 1 Protect, where projects incorporate [Active, Beautiful, and Clean \(ABC Waters\)](#) design features for sustainable stormwater management to maintain the quality of water in waterways and reservoirs and enhance biodiversity and the living environment. Projects that attain PUB's ABC Waters certification can be considered for points under Innovation.

Living Future Institute Certifications

Living buildings are regenerative buildings that connect occupants to light, air, food, nature and community. It is self-sufficient and remain within the resource limits of their site. They create a positive impact on the human and natural systems that interact with them.

The Living Building Challenge is a holistic standard, requiring projects to strive for the ideal across the seven performance areas known as Petals.

1. Place. Restoring a healthy interrelationship with nature
2. Water. Creating developments that operate within the water balance of a given plans and climate
3. Energy. Relying only on current solar income
4. Health and Happiness. Creating environments that optimise physical and psychological health and well-being
5. Materials. Endorsing products that are safe for all species through time
6. Equity. Supporting a just and equitable world
7. Beauty. Celebrating design that uplifts the human spirit

International Living Future Institute Certifications

- Core Green Building Certification:

Core Green Building Certification (**Core Certification**) is for projects seeking a high aspiration certification that is verified, holistic and readily achievable. Projects must meet the requirements of the ten Core Imperatives – up to two Core Imperatives per Petal – and verify performance for water and energy through a twelve-month performance period.

- Living Building Challenge Certifications:

The Living Building Challenge is a holistic standard, requiring projects to strive for the ideal across the seven Petals (Place, Water, Energy, Health and Happiness, Materials, Equity and Beauty).

Petal Certification:

Petal Certification is for projects that want to do a deep dive into one issue area, or Petal of the Living Building Challenge. This certification requires the achievement of all the Core Imperatives, in addition to all Imperatives in either the Water, Energy, or Materials Petal.

Living Certification:

Living Certification is for projects striving for the highest level of sustainability and regenerative design. A project achieves Living Certification by attaining all Imperatives assigned to its Typology.

Assessment Criteria

Living Future Institute Certification	Points
Core Certification	5 Points
Petal Certification	10 points
Living Certification	15 points

- Projects that have attained Living Future Institute certifications would be accredited the respective Green Mark points in the Resilience section.
- Projects that have attained Living Building Challenge Petal Certification or Living Certification will also be awarded the Resilience badge.

- For projects that have attained the Core Green Building Certification, additional points can be attempted within the Resilience section to achieve the Resilience badge, that are not duplicated in the Core Green Building Certification criteria.

Documentation Requirements

A copy of the certificate of the Living Future Institute Certification i.e. Living or Petal Certification under Living Building Challenge, or Core Green Building Certification.

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