



## Water sensitive urban design

### Green walls, facades and roofs

#### Introduction

Green walls, facades and rooftop gardens are increasing in popularity for their capacity to cool our cities, help manage storm water and improve amenity, community wellbeing and air quality.

A green wall is a vertical structure planted with vegetation that contains a growing medium and a built in irrigation system.

A green façade is typically created from climbing plants and/or groundcovers either directly growing onto a wall or via cable, mesh or trellis systems.

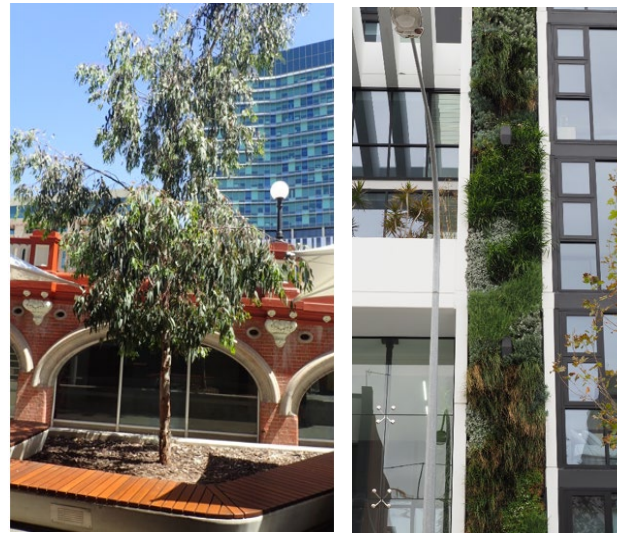
Traditionally, a green roof is a roof of a building that is covered in vegetation. However, green roofs are more recently being created through the planting of trees and other vegetation into a growing media on any built structure at any level of a building.

#### Opportunities and benefits

Green roofs, walls and facades are associated with many environmental, social and economic benefits including:

- reduced energy use within buildings
- contribution to urban cooling and microclimate
- creation of urban green space
- opportunities for biodiversity, habitat and food production
- contribution to management of stormwater volumes
- improved stormwater quality
- improved air quality and noise reduction
- human health and wellbeing benefits
- increased property value

Consideration of these benefits should inform the agreed project goals.



Trees planted in structure cells on podia (image 1) and external vertical green wall (image 2)

#### Design process and considerations

The following steps are recommended for the successful creation of green walls, facades and roofs.

1. Undertake a site analysis, having consideration of:

- external/internal location
- daily/annual temperatures
- aspect including daily/annual movement of sun/shade
- exposure to prevailing winds/air conditioning /evaporation rates
- heat reflection from neighbouring buildings or windows
- rainfall/drainage/runoff onto the structure
- load-bearing capacity of location
- safety in design and access for installation and maintenance
- irrigation source.

2. Design the green infrastructure solution having consideration of the design brief and design goals – choose the following:

- Structure - In response to the design brief and site analysis, determine which type of structure is most appropriate i.e. roof, wall or façade. Consideration must be given to weight of the plants at maturity as well as the system itself.
- Media – Identify an appropriate growing media having consideration of weight, water holding capacity, nutrient holding capacity, permeability/ porosity and pH. Common media includes combinations of cocopeat, perlite, sphagnum moss, vermiculite, vermicompost, shredded bark and leaf moulds. Soil is not usually an effective media in large proportions due to its weight.
- Plants – The best plants for green walls are dense, compact and low growing, while the best plants for facades will depend on the mode of plant attachment. The best plants for green roofs are highly dependent on the location and vision for the building. Species should be chosen for the particular conditions of the location i.e. amount of sun, shade, water and wind. Note that for green walls, the bottom of the unit is likely to hold more moisture than the top.
- Water source and drainage – consider opportunities for alternative water sources including greywater and stormwater (see Fowdar et al, 2018).
- Irrigation – Effective water management is one of the most challenging elements in WA. Irrigation systems should be designed in accordance with the requirements in Box 1.

3. Installation

- Obtain the growing media from a supplier who complies with the industry best practice guidelines of the Nursery Production Farm Management System.
- Ensure the plants are established 3-4months in advance at an accredited nursery.
- Consider the need for a structural engineer to confirm and certify the load-bearing capacity of the location.



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#### 4. Maintenance

The system should be inspected and maintained regularly in accordance with an agreed program, giving consideration to:

- Pests and diseases – which are influenced by the quality of the plant stock, airflow around the plants, permeability of the media, and watering and fertiliser regime. Common pests and diseases include fungus gnats, mealy bug, scale and root rot.
- Timing – Inspections should be regular and will depend on the location and design.
- Resources - Develop the maintenance program early in the design process (Step 2) so all parties are aware of the ongoing requirements and likely costs. The design should be amended if the on-going costs are considered too high. Insufficient maintenance is cited as one of the most significant reasons for failure of green infrastructure.
- Skills required – The systems should be inspected and maintained by qualified horticulturalists. Some systems may also require specialist equipment and training to manage locational issues such as heights.
- Tasks to be undertaken – will include weeding, pruning, plant replacement, adjusting irrigation and fertigation systems, and flushing the valves and system.

#### Obtaining an exemption to allow daily watering

The Water Corporation has established a Vertical Wall exemption to Regulation 77 of the Water Services Regulations 2013. (Regulation 77 prohibits the use of scheme water that contravenes the applicable water use restrictions). The requirements for the exemption are:

- Applies to the use of scheme water for the purposes of watering plants in a green wall, façade or roof.
- Only applicable in the Perth-Peel Region. Regional applications will be assessed on a case-by-case basis.
- Each system must be metered, with a requirement to monitor and record water use.
- The irrigation system may operate a maximum of three times per day. The amount of water applied weekly must not exceed 20mm per m<sup>2</sup>.
- The construction and management of a green wall must follow industry Best Practice Guidelines (Water Corporation 2020).
- The proponent should apply for the exemption via the Water Corporation website.

The Water Corporation can conduct an audit of the water use for the vertical garden to ensure it is complying with the conditions. A review of the exemption will be conducted every four years.

Image 1: Internal green wall

Image 2: Green Roof

#### Box 1: Key Irrigation Requirements

- automated system fitted with a meter, backflow prevention device and flush valves
- deliver water through drip irrigation devices
- soil sensors to monitor moisture in rootzone
- system to allow fertigation
- system to be monitored, preferentially linked to a weather station via wi-fi
- appropriate management of runoff including reuse (e.g. into purple pipe in nearby garden beds) if applicable
- design stations to cater for different microclimates
- operate a maximum of three times per day and the amount of water applied weekly not to exceed 20mm per m<sup>2</sup>.

#### References

Cooperative Research Centre for Water Sensitive Cities (2020). Designing for a cool city—Guidelines for passively irrigated landscapes. Melbourne, Victoria: Cooperative Research Centre for Water Sensitive Cities.

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

Fowdar, H., Deletic, A., Hatt, B.E and Barron, N. (2018). Adoption Guidelines for Green Treatment Technologies. Melbourne, Aus: Cooperative Research Centre for Water Sensitive Cities.

Landscape Industries Association WA <https://landscaping.net.au>

Nursery & Garden Industry WA <https://www.ngiwa.com.au>

Nursery Production Farm Management System <http://nurseryproductionfms.com.au>

Water Corporation, 2020, Vertical Garden Walls – Industry Best Practice

