

Green Roofs, Walls and Facades

Building design for a sustainable future



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This fact sheet provides information about green roofs, walls and facades that can be designed to cool a building, help reduce stormwater runoff, increase biodiversity and provide more greenery in the city - which is known to reduce people's stress levels and improve mental health. Incorporating vegetated roofs and vertical surfaces into existing and new developments can increase the appeal and marketability of properties. This fact sheet has been developed from the Growing Green Guide: A guide to green roofs, walls and facades in Melbourne and Victoria, Australia.

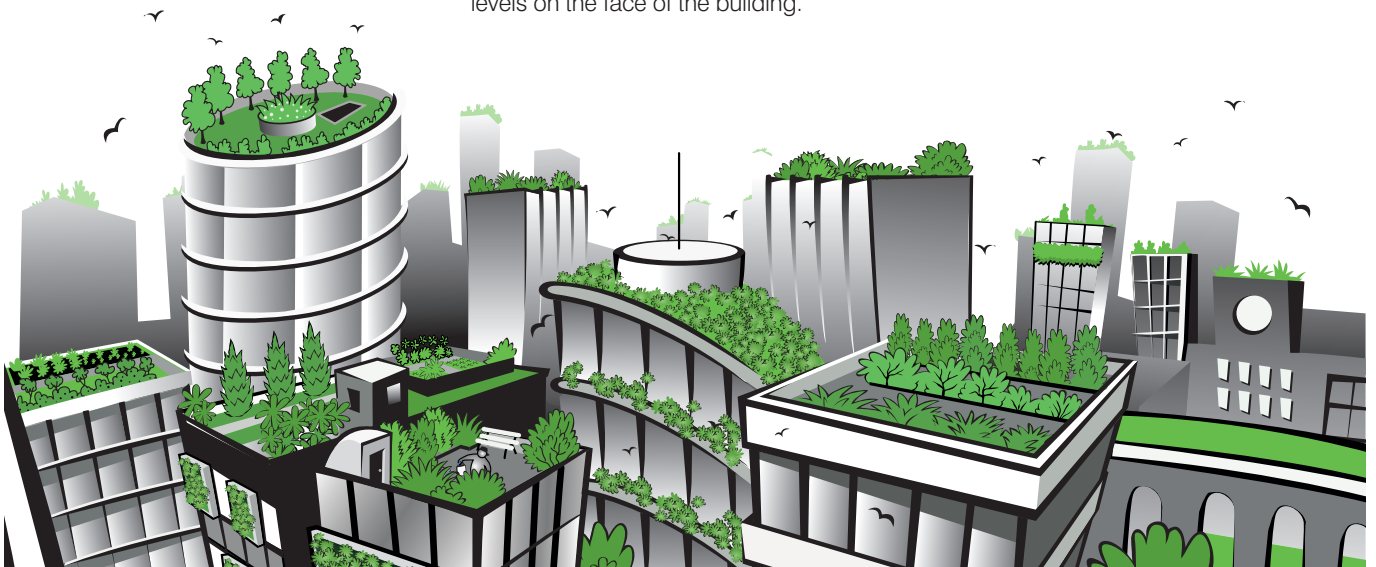
What are green roofs, walls and facades?

A green roof is a vegetated landscape that is installed on a roof surface, and is built up from a series of either loose-laid layers, or modules made of pre-prepared layers in trays. Vegetation on green roofs is planted in a growing substrate that can range from 50mm to over 1 metre in depth, depending on the weight-bearing capacity of the building's roof and the design objectives.

Green facades are created by growing plants up and across the face of a building. Plants are either rooted in the ground or grown from containers installed at different levels on the face of the building.

Climbing plants can attach directly to the surface of a building or be supported on a structure independent of the building.

Green walls are plants grown in vertical systems that are usually attached to internal or external walls. Green walls differ from green facades in that plantings are made across the entire vertical structure, as opposed to planting at the base of the structure to enable vertical and horizontal growth. In a green wall, plants, growing medium, irrigation and drainage are incorporated into the system.



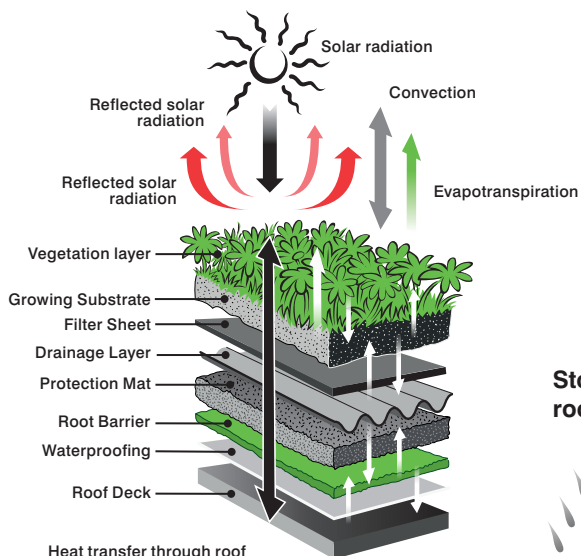


What are the benefits of green roofs, walls and facades?

A well designed and maintained green roof, wall or facade can provide:

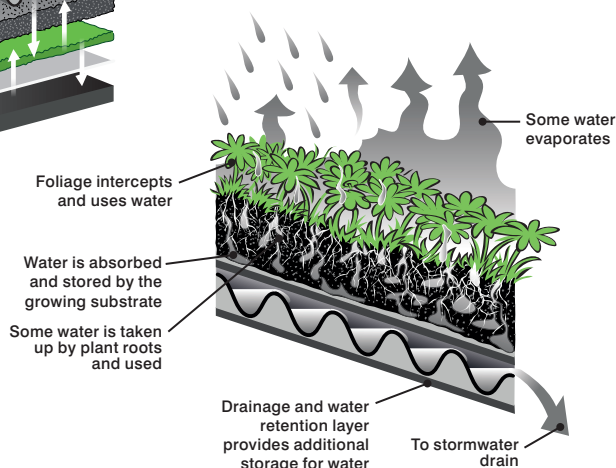
- aesthetic improvements in highly visible locations
- protection of building materials leading to an increased lifespan of those materials
- reduced building heating and cooling costs due to increased insulation
- green spaces (and sometimes usable recreation spaces) in densely built environments
- increased property value
- food production areas for residents or commercial tenants
- rain water run-off management and water filtering/pollution reduction
- habitat creation and increased biodiversity
- cooling effect for the city – where there is a high density of green roofs, walls, facades and other types of greenery such as street trees
- cleaner air, with less pollutants.

Cooling on a green roof



Heat transfer through roof
Heat transfer is reduced on a green roof because the growing medium has some insulating effect and the vegetation shades the building.

Stormwater management on a green roof



The three key areas of development

Design

Well considered design is vital to realise the potential benefits of a green roof, wall or facade installation. If a green roof is intended to increase the permeable surface on a site, and to decrease stormwater run-off, a deep layer of growing substrate should be used. Design considerations also include understanding the site's aspect and exposure so that suitable plants are selected. One of the most important design considerations lies in understanding the structural load that the wall or roof can take to determine what can be installed. If structural capacity is limited it may be possible to reinforce the walls or roofs to increase the weight loading capacity. Design must also take into account the project budget and a realistic assessment of the resources available for ongoing maintenance.

For shallower designed green roofs, also known as extensive green roofs, the benefits of reduced stormwater run off is less in comparison to the deeper intensive green roofs.

Installation

Roofs, walls and facades can be installed on existing buildings, or built into new structures. In new builds it is important that the green roof, wall or facade installer is involved in discussions with the project team during the design phase, and not just brought in later to work around the existing conditions. Care must be taken where multiple contractors are involved in an installation that no damage is made to earlier work, for instance to the water proofing membrane, and that warranties and insurance liabilities are clear.

Access for builders can be difficult and consideration must be given to OH&S requirements for working at heights. Irrigation systems are usually incorporated into green roof, wall and facade installations, and thought should be given to water collection and storage, and in some cases water re-use through the system.



Maintenance

Maintenance is critical to the success of a green roof, wall or facade. Maintenance will depend on:

- irrigation in particular must be maintained to ensure proper operation
- the vigour of the vegetation
- use of the roof or facade (e.g. if growing food versus creating a biodiversity space)
- aesthetic preferences for the roof, wall or facade
- number of likely weed seed sources around the site.



Design goals and considerations

The following tables provide some examples of different considerations for different design goals. This is not an exhaustive list, and is intended only to illustrate that different goals will require different inputs and system set ups.

Discussions with professional green roof, wall and facade installers, landscape architects, structural engineers and a review of relevant research will be needed to make final decisions about the most appropriate approach.

Green roofs

Design goals	Design Considerations
Reduced stormwater run-off	Increase depth and water-holding capacity of substrate, and include plants that can adapt their water use
Recreation and amenity use	Increase weight loading, ensure safe roof access, planning and safety requirements
Maximise thermal insulation	Increase substrate depth, provide irrigation, select species for leafy plant cover in summer (passive heat gain in winter may be increased if the roof is bare in winter but this strategy increases maintenance and reduces aesthetic benefit)
Provide biodiversity outcomes	Include habitat plants and features (such as water, food and shelter), and consider including small changes in topography and variation in substrates



Green walls

Design goals	Design Considerations
A multi-storey green wall	Ensure access for maintenance is possible, consider a lightweight growing system if structural loading capacity is limited. Ensure species selection is appropriate for specific light and wind exposures at different heights
Low cost and easy to install on a residential building	Consider DIY installations, the size of the green wall systems that can recirculate irrigation runoff water, systems that can be easily maintained
Internal green wall	Ensure adequate light is available to support plant growth. This can also be achieved by installing a specialised artificial lighting system
Aesthetics and a design statement	Include a variety of species with extensive and different flowering times; consider planting in patterns and including different textures and colours or foliage



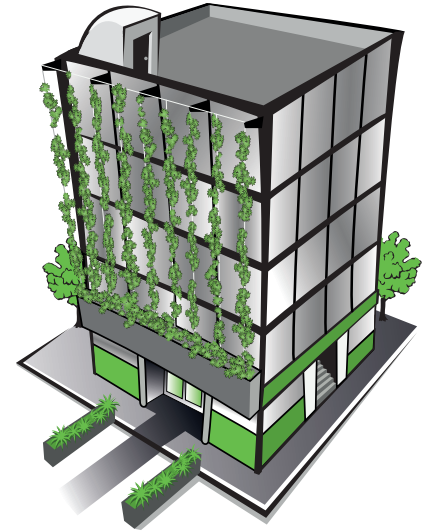
“ We know the city can be 4 to 7 degrees hotter than surrounding suburbs due to the urban heat island effect. Green walls, facades and rooftops not only look good but help cool our city and retain stormwater which can help reduce flash flooding.”



Design goals and considerations

Green facades

Design goals	Design Considerations
Low cost and easy to install	Use a climbing plant species that attach directly to the wall, grown in a planting bed at ground level. Seek advice to ensure the best selection of plant types for your building structure
A multi storey facade greening	Include containers at different heights, include cabling or lattice support structures for twining plants, ensure access for maintenance, provide irrigation, consider secondary protection of plants against stem damage (e.g. wind protection trellis)
Screening of an unsightly view	Use evergreen species to ensure year round screening, create a structure for the plants to grow on as the screen. Usually this is mesh or cabling, and twining species of plants are used
Maximise thermal benefits	Use deciduous species if heat gain is desired in winter; ensure very leafy plants, covering the entire wall for providing best shade in summer, particularly on north and west facing walls; provide a structure at least 100mm off the wall of a building for the plants to grow on, leaving an air gap between the building and green plants to maximise cooling effect



Where can I find out more?

The Growing Green Guide provides advice on how to design, construct and maintain green roofs, walls and facades in Victoria, Australia.

Growing Green Guide
<https://www.melbourne.vic.gov.au/community/greening-the-city/green-infrastructure/Pages/growing-green-guide.aspx>

Your Home Technical Manual

Your Home
www.yourhome.gov.au

Landscaping Victoria

Ten things to consider
www.landscapingvictoria.com.au

Green Roofs Australasia

greenroofsaustralasia.com.au

Other Fact Sheets in this series are also available to provide guidance on the 10 Key Sustainable Building Categories. For further relevant information, consider the Fact Sheets entitled:

- Urban Ecology
- Stormwater Management
- Water Efficiency
- Energy Efficiency

Mandatory Requirements and Council's Design Advice

Environmental Sustainable Design (ESD) Principles

There are two levels of compliance when it comes to ESD principles – mandatory and best practice.

Mandatory Requirements

The design, construction and installation of green roofs, walls and facades is subject to the normal planning and building permits, approvals and consenting processes. Specific information should therefore be obtained from planning authorities prior to the commencement of any such projects.

Council's Design Advice

- Design the system to provide the maximum number of benefits
- Use non-potable water to supply any irrigation systems
- Enhance the ecological value of your site through inclusion of habitat features and plants
- Cover as much area as possible with vegetation to maximise thermal benefits; for green roofs, maximise the planting area for greatest stormwater benefits.