Sustainable Building Guidelines

Environmentally Sustainable Design Guidelines for Capital Works

Banyule
City Council

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1 Foreword

I am very pleased to introduce you to Banyule's Sustainable Building Guidelines.

Climate action is a top priority of Council. We have developed the Corporate Emissions Reduction Plan (CERP) and Community Climate Action Plan (CCAP) to solidify our position, policies and decision making to reach a target of carbon neutrality by 2028.

These guidelines provide the framework to help Council's capital works program produce zero net emissions buildings. Capital works contribute significantly towards achieving our sustainability targets, so it is vital that everyone plays their part towards achieving this goal.

The Guidelines have been developed collaboratively with our Councillors, Council staff and the community and are a product of consultation, innovative thinking and Council's commitment towards both the CERP and CCAP.

I am incredibly proud of this initiative and the climate action work that we are doing.

Allison Beckwith

Chief Executive Officer

Banyule City Council

2 Introduction

Banyule City Council is responsible for over 200 buildings that are utilised by Council and the community. As large consumers of energy, water and other resources, buildings play an important role in achieving Council's vision of Banyule as a green, sustainable and vibrant place for a healthy, connected and inclusive community.

2.1 Purpose

The purpose of the Sustainable Buildings Guidelines is to:

- enable Council to achieve and exceed its targets of zero net emissions by 2028 as identified within its Corporate Emissions Reduction Plan (CERP) 2020-2023
- incorporate sustainable design and operations into all Council buildings in a consistent way, in the interests of the community in terms of benefits and lifecycle costs
- to demonstrate corporate responsibility and leadership to the community
- set out clear, industry-understood commitments/requirements for achieving improved sustainability standards in the way Council's buildings are planned, designed, built, used and maintained

2.2 Scope

The Guidelines apply to, where practical:

- all capital works, including:
    - **new buildings** owned, leased or managed by Council
    - projects to maintain, upgrade, renovate, retrofit and refurbish **existing buildings**
    - projects to fit-out, upgrade, renovate and refurbish **interiors**, where there is no alteration to the envelope or major systems of a building
- maintenance and repair work
- council staff, project managers, designers, architects, engineers, contractors and stakeholders involved in capital works and maintenance projects. (This may include tenants also.)

Currently, the predominant building space types associated with Council operations include:

- sports pavilions and leisure and aquatic centres
- community centres and planned activity spaces
- maternal child health and preschools
- disability support
- offices

A note on energy use and space/building types: offices and some other commercial space types tend to be *internal load dominated*, which means that they tend to produce much of their own heat through their operations. Community Centres can vary, depending on what activities are present. Their energy use profile can vary from that of say a residential living room to something more like an office if they are busy. Spaces related to exercise tend to require a higher volume of outdoor air, and do not usually require much heating for most spaces. Because physically active users are producing their own heat when exercising, many spaces related to exercise can be set at a lower temperature heating setpoint. The exception to this is indoor pools, which usually require much more heating demand for both pool water and space conditioning.

3 Background and Council Context

Banyule City Council's vision is to be 'a green, sustainable and vibrant place for a healthy, connected and inclusive community'. The core values that help Banyule achieve its vision are respect, integrity, responsibility, initiative, inclusion and leadership.

Banyule has adopted a leadership position in taking action on climate change. In December 2018, the Council passed a notable Climate Action Resolution – in doing so establishing a carbon neutrality target by 2028 without the use of offsets. The ambition behind this target has since continued, with the declaration of a climate emergency in October 2019 reinforcing the need for strong and urgent action.

3.1 Alignment with corporate framework & policies

This document supports the objectives and key directions outlined in Council Plan 2017-2021, and particularly those listed below:

1. People: strong, healthy and inclusive communities
    1.1. Support and promote health and wellbeing
    1.2. Provide a range of services for people at important life stages
    1.3. Support a connected, inclusive and involved community
2. Planet: environmental sustainability
    2.1. Protect and enhance our natural environment
    2.2. Lead in planning for, and responding to climate change
    2.3. Avoid waste generation
    2.4. Be environmental stewards
3. Place: great places and spaces
    3.1. Renew and maintain Banyule's public assets and infrastructure
    3.2. Support sustainable transport
4. Participation: engagement and advocacy
    4.1. Engage meaningfully with our community and encourage participation
5. Performance: efficiency and good governance
    5.1. Deliver best value services and facilities
    5.2. Provide responsible financial management and business planning
    5.3. Provide good governance and be accountable
    5.4. Manage the systems and assets that support service delivery

Additionally, these Guidelines are linked strategically to the following adopted policies/plans:

- Banyule's Corporate Emissions Reduction Plan 2020-2023
- Banyule's Community Climate Action Plan 2020
- Banyule Planning Scheme 22.05 - Environmentally Sustainable Development

3.2 Regulatory context

The Sustainable Buildings Guidelines align with several Council policies as listed above. The Guidelines work in conjunction with and are intended to support all statutory building and planning requirements. The requirements of these Guidelines do not replace statutory requirements such as the National Construction Code.

3.3 Building Green for community, habitat and environmental health [1]

Sustainably designed buildings benefit human and environmental health, and often include social and economic benefits. Inclusion of ESD principles commonly result in significant building operating cost savings with minor to medium additional capital costs. The information below outlines some environmental savings, return on investment and increased productivity associated with sustainable buildings. The Sustainable Buildings Guidelines will help deliver affordable buildings that are energy and water efficient, more cost effective to operate and comfortable to use, and better align Council building works with its Corporate Emissions Reduction Plan (CERP) 2020-2023.

In *Green Star in focus: the business case*,[2] the Green Building Council of Australia (2020) found that that globally, green buildings 'deliver a range of quantitative and qualitative benefits: lower operating costs and higher returns, enhanced productivity … and better learning outcomes … Green buildings reduce stress on the electricity network, support a least-cost pathway to a carbon positive built environment, and improve the resilience of households and businesses. Specifically:

- 20% savings of total construction costs over a building's lifetime from energy efficiency alone
- up to 52% productivity gains from improved ventilation, access to daylight and operable windows, and well-designed lighting
- up to 76% improvement in employee wellbeing and perceived productivity
- 42% improvement in health environments
- produce 55% fewer greenhouse gas emissions than standard practice new buildings
- use 66% less electricity than average Australian building
- use 51% less water than the average Australian building
- recycle 96% of their waste, compared with 58% for the average new construction project

Recent research indicates a very strong correlation between green buildings and improved cognitive function[3]. Lower electricity use also means less risk to rising energy prices. For the investor, benefits include higher demand, low vacancy, and satisfied occupants.

[1] This section is includes elements of Moreland Sustainable Buildings Policy 2018. The symbol '□' also designates this later in the document.
[2] GBCA 2020. https://gbca-web.s3.amazonaws.com/media/documents/gbca-green-star-in-focus-the-business-case-v1-r6-digital-spreads-reduced-size.pdf
[3] https://thecogfxstudy.com/

3.4 Assessing Benefits and Lifecycle costs

Investments in energy efficiency and other sustainability measures offer a long-term return in terms of energy savings and other harder-to-quantify benefits over the entire lifetime of the components or buildings. As such, decisions related to capital expenditure for energy efficiency and other sustainable building measures need to be balanced with savings (and with consideration for other benefits) over the life of the components or buildings. Net present value (NPV) is to be used as a capital budgeting method, with recurring energy cost savings should be calculated as NPV.

For the purpose of assessing lifecycle costs, it is standard practice to estimate the design life for:

- building fabric enclosure and in-ground site services, at around 50 years. (Note that these components are extremely difficult and expensive to change after building or renovating.)
- internal fit-out and building services capital equipment, ie. electrical boards, wiring, switches and outlets, fittings, hydraulics and some mechanical equipment, at around 20-30 years
- residual life cycle for retained building elements and components after a mortgage is paid off (only applicable if this type of financing is applicable to a project)

3.5 Rules of thumb for reducing upfront costs

The cost of the better building fabric enclosure is most affordable at the time when the building is built or renovated and cannot be added later without significant added costs. Projects should optimise value for money and should avoid making decisions that increase maintenance, energy or other recurring costs.

In terms of upfront cost reductions in the **building envelope**, consider[4]:

- **compact building forms**, which save construction costs and minimise energy losses. The Passive House Institute[5] stipulates that a favourable building compactness, also known as area-to-volume ratio or Heat Loss Form Factor, is to be no more than 0.7 m^2/m^3.
- **insulation thickness** - roof insulation can usually be increased without considerable additional cost impacts, as compared to added wall insulation.
- for **windows**
    - East and west facing windows should be as small as possible because of costs and overheating risk.
    - Optimised orientation solar gain avoidance (unless solar gain is beneficial for a particular use)
    - External shading to windows, which can be as simple as deeper window heads, or building components such as overhangs or awnings.

[4] Passive House Designer/Consultant Course, Course Notes vol. 2, F1 Economic Passive House Buildings, EN- F.1-13-2016.

[5] Passive House Designer/Consultant Course, Course Notes vol. 2, F1 Economic Passive House Buildings, EN- F.1-12-2016. More on the building compactness and Heat Loss Form Factor can be found in Elrond Burrell's Passivhaus in Plain English blog post 'What is Heat Loss Form Factor?'.

    - Higher glass-to-frame ratio, with few mullions improves energy performance and reduces costs, as high performing frames are expensive.
    - Argon filled glazing is preferred if possible, as it's more insulative than air.
- **airtightness,** which can reduce the requirement for higher levels of insulation of the building fabric, ie. Window glazing could be of a lower performance, such as argon-filled rather than kryption-filled IGUs.

In terms of reducing upfront costs to **building services**, consider:

- short ducts by situation extract air zones, ie. toilets in close proximity to one another, ie. adjacent or above/below
- air supply and extraction is located in separate areas or rooms, with clear divisions of the rooms as supply air, transferred air and extract air zones
- if necessary, heated surfaces can be installed on an interior wall
- easy-to-access for maintenance-intensive components like filters
- flexible bend silencers, which reduces ducting and installation costs

In terms of reducing lifecycle costs, **building materials** to help avoid thermal bridges such as:

- timber
- porous concrete
- polyurethane materials
- stainless steel, when steel penetration through the building fabric cannot be avoided

4 Responsibilities

4.1 Assets & City Services Directorate

The Assets & City Services Directorate is responsible for creating and implementing these guidelines as well as its ongoing review.

The guidelines should be reviewed annually by the steering committee to ensure they are updated in accordance with current day best practice and provide continuing alignment with Council policy and objectives. In addition, an annual self-audit by council officers comparing project outcomes with the guidelines will be undertaken to enhance learning opportunities and help imbed a cultural of continuous improvement.

4.2 Consultants & Contractors

Consultants must provide a completed ESD matrix with these guidelines at the end of Design Development and Contract Documentation. The design is to be held accountable to the guideline criteria.

This shall include supporting evidence of any Council approvals for items that are deemed as non-complying. Failure to comply without exemption may result in the consultant rectifying the non-compliance at their own cost.

A council representative will confirm in writing to the consultant any approved departure from these Standards. No works are to proceed until sign off has been received for each of the design stages.

A project specific Construction Environmental Management Plan (CEMP) should be provided by the main construction contractor and approved by an authorised council officer.

5 Implementation

The Assets & City Services Directorate is responsible for implementing these guidelines through the planning, design, project management, construction, maintenance and operation of Council facilities.

Consultants will be provided with a current copy of this document and any other relevant Council planning and design documents.

5.1 Formal review phases

The Project phases involving formal Environmentally Sustainable Design review are as follows:

Project phases	Hold point for review & approval
1. **Project Initiation for larger or complex projects**	Project manager to confirm design team clearly understands expectations and criteria on which the design will be evaluated.
2. **Concept Design (hold point for review and approval)**	Check compactness and windows against rules of thumb (see section above).
3. **Schematic Design (hold point for review and approval)**	Check compactness and windows against rules of thumb (see above). Preliminary 'red pen test' delineating extent of the conditioned space(s) to be checked for aquatic centres and other heavily conditioned spaces.
4. **Detailed Design / Contract Documentation (hold point for review and approval)**	Check compactness, windows, building services and materials against rules of thumb (see above). Perform 'red pen test' for all conditioned projects. (2nd test for pool halls and other heavily conditioned spaces).
5. **Contractor Commencement**	Construction Environmental Management Plan [6]
6. **Practical Completion**	Final sign off. Include blower door test for heavily conditioned spaces.

Note: Different project types and sizes will vary in their design phases and hold points however ESD review must occur at Concept Design, Detailed Design, Contract Documentation and Practical Completion as a minimum requirement for all projects. Hold points are to be approved by the Assets & City Services project manager.

[6] See 8.8 Management, Responsible Construction Practices on page 34

5.2 Banyule Environmentally Sustainable Design (ESD) Matrix

To assist in the implementation of the policy, a project implementation tool has been developed – the Banyule ESD Matrix. This tool is designed to integrate with existing project management framework and enables project managers to:

- clearly scope project ESD requirements at project inception
- track compliance with ESD requirements by project architects and consultants
- incorporate critical hold points for detailed review of design documentation and specifications

The project specific Banyule ESD Matrix is to form part of the tender specification to enable consultants and contractors to understand and allow for all ESD requirements in their tender responses.

At each project phase the design team is to take ownership of the ESD Matrix and demonstrate compliance with all requirements in the building design and documentation.

Upon commencement of construction, the Contractor is to take ownership of the ESD Matrix and demonstrate compliance with all requirements by submitting to Council upon commencement a Construction Environmental Management Plan with the completed Matrix attached including any supplementary documentation required by specific targets.

5.3 Roles and Responsibilities

Roles and responsibilities for implementing this policy are outlined below:

Party	Responsibility
Project Sponsor / Client	General oversight and meet with Project Manager to determine scope and associated costs.
Project Manager / Engineer	Ensure guidelines are included in project documentation, ESD matrix is completed, review of non-conformances, liaise with ESD Adviser or Environmental Sustainability Team to obtain approval for non-conformances and monitor ESD matrix, as appropriate.
Environmental Sustainability Team	Review non-conformances, project matrix and provide general ESD advice
ESD Adviser	Provide independent project review and advice relating to ESD implications.

6 Monitoring and Review

These guidelines will be reviewed annually to ensure its relevance in terms of community needs and expectation, Council goals, target and statutory requirements, and improvements in standards and technologies.

If and/or when guidelines are next under review, the following ESD rating tools may helpful for gauging breadth, depth and what guidelines should be required versus voluntary:

- Core Green Building Certification, by the International Living Future Institute, which aims to be a simple framework that bridges the gap between the highest levels of green building certification and the aspirations of the Living Building Challenge
- Green Star Buildings, by the GBCA; any guidelines that align with GSB's 'minimum expectations' can use this tool to justify it as a requirement.
- WELL Health Safety Rating for Facility Operations and Management is an evidence-based, third-party verified rating for all new and existing building and facility types, which is designed to prioritise human health. The parts most applicable in terms of Council maintenance and capital works are those to do with operational policies and maintenance protocols.

For projects where performance verification is of particularly priority to Council – such as for aquatic centres – formally registering the project to undergo a Green Star Performance rating tool should be considered. This requires that a project is operational so that measurements can take place.

7 Sustainability Objectives Summarised

The sustainability objectives that apply to works covered under these guidelines are to:

- protect and enhance the **ecology** for natural and built environments
- support and advocate for **active, inclusive transport** options
- ensure the efficient use of **water**, reduce potable water use and **achieve best practice stormwater** quality outcomes
- improve and support **comfort, health and wellbeing** outcomes for building users
- **reduce energy and greenhouse gas (GHG) emissions reduction** through
  a. avoiding high environmental impact refrigerants
  b. passive design measures including insulated building fabric to reduce heating and cooling energy use
  c. ensuring the efficient use of energy and avoid usage whenever possible
  d. no usage of gas except when approved by Director
  e. creating Net Zero Energy buildings
- ensure **waste avoidance** through appropriate selection of durable materials, reuse and recycling of building materials during design, construction, operations and end-of-life performance
- advocate for the selection of **environmentally and socially responsible building materials**
- **reduce building lifecycle costs**, including upfront and operational costs, and ensure long term reusability of building materials
- support and advocate for building performance **measurement and management**

The guidelines have been grouped within categories closely aligned with the above objectives.

Note: Different building project types vary in their ability to improve sustainability. It is recognised that projects may not need to embrace all categories to achieve an acceptable level of sustainability as the scope of works of the project will limit the ability to target every objective. It is not intended that the mandated scope of works is extended in order to satisfy all objectives.

8 Guidelines

The following guidelines are considered to be the minimum requirements for all capital works and building maintenance projects in order to achieve the objectives outlined above. Each set of guidelines provides an overall intent and this should be used as a guide when proposing a suitable design, upgrade or construction response.

Consultants and contractors are encouraged to propose additional responses above and beyond these guidelines to assist with achieving the best project outcome.

The guidelines are grouped by category. The order of the categories is intended to align with the design process, starting from the general site scale considerations for concept design first and then with building and component scale considerations for detailed design and beyond after.

Aquatic centres are a complex and varied building type. As such, pool related guidelines are subject to annual reviews by internal team and consultant, and updated as better information, standards and technologies become available.

For all relevant projects / programs, with a gross floor area greater than 1000 square metres, the project team should be required to develop a Sustainability Management Plan (SMP) that documents how all ESD objectives, targets and standards will be met, and how the performance outcomes will be achieved.

The SMP must also provide a schedule for implementation, ongoing management, maintenance and monitoring and how the ESD elements and practices can be maintained over time. The SMP should be used to survey available sustainable technologies and innovative approaches and to resolve any questions around feasibility of applying ESD initiatives to the project or program. For a program of works, one regularly updated SMP will generally meet requirements.

Where Green Star tools are referenced, the design team should use the appropriate Submission Guidelines and submission template for credit identified, in order to fulfil the ESD Guideline. These may be found on the GBCA's Green Star resources website.

Legend

The guidelines below may be more applicable to some building types than others. For the purposes of maintaining these guidelines, it may also be useful to know their origin, and whenever possible, sources are cited, and resources identified. The designations below are currently used:

Symbol/text	Meaning
_GS_	This guideline to be measured against using the associated Green Star submission template, calculators, and other documents as appropriate to the Green Star tool and credit referenced.
AQUATIC	Designates guidelines *with special consideration* for aquatic centres and pools. Other guidelines may also apply to aquatic centres, unless specifically noted otherwise. Where a guideline applies only to aquatic centres, "ONLY" is added.
EXISTING	Designates that this guideline is particularly applicable to, or has special consideration for works to existing buildings. This does not necessarily mean that the guideline does not apply to other types of works, however, and each project should consider it for applicability.
□	This guideline includes elements of Moreland Sustainable Buildings Policy 2018, though with considerable changes, including those tailored for Banyule's context.

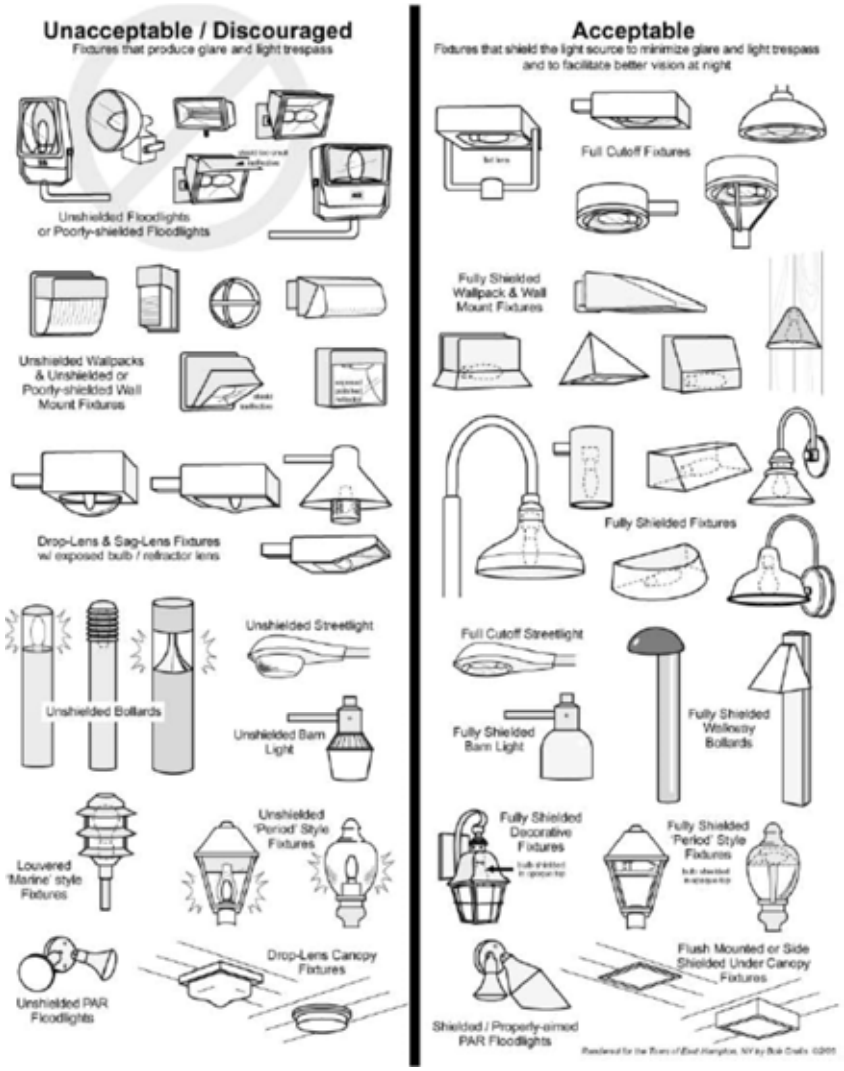
8.1 Place Ecology

Intent: protect, restore and enhance biodiverse habitats and our natural environment and encourage ecological regeneration and enhanced function of communities and places where projects are built.

Applies to: projects that interact with site ecology, ie. landscaping, additions or roofing changes. See each guideline below for details.

Endangered, Threatened or Vulnerable Species _GS_	The project must demonstrate that no critically endangered, endangered or vulnerable species or ecological communities are present on the predeveloped project site. If the site was previously hard surface prior to the proposed project, it automatically complies. For other options and details, *see Green Star Design & As Built (GS D&AB) credit 23.0 Endangered, Threatened or Vulnerable Species*.
Support Biodiversity □ _GS_	**Applies to: changes, reductions or additions to landscape. Where green roofs, walls and/or facades are proposed the applicability of this guideline is to the discretion of Council's Biodiversity Adviser.** The project is to incorporate **landscape** design & plant selection features: • Enhance the ecological character and biodiversity of the site and result in no net loss of biodiversity on the site. Plant selection to be suitable to the local Ecological Vegetation Community (EVC)[7]. This is especially critical for sites in proximity of wildlife corridors.[8] If there is any doubt about the biodiversity on the site, then biodiversity may be 'measured' for pre- and post-development using the *Green Star Ecological Value Calculator*. *See Green Star Performance v1.2 credit 24.2.1 Measuring biodiversity*, and also *Green Star: Change in Ecology Calculator Guide*. • Ensure that the **design retains and plants canopy trees** where possible. Retaining canopy trees in urban areas[9] and significant trees[10] (whether they are included in the Significant Tree Register which is continually updated) are of particular importance. Director approval is required for any canopy or significant trees are not fully retained, and the project must provide a value proposition of what is to be gained ecologically and otherwise, as compared to what is lost. Any replanting program to consider indigenous planting opportunities alongside neighbourhood character, as outlined in the Urban Forest Strategy • Provide **high quality amenity green space for building occupants**. *See Comfort & Wellbeing - High Quality Amenity Spaces.* • Consider using the concept of xeriscaping to design in different landscape and planting zones based on the differences in microclimate within a project; plant selection to be based on proximity to water, sun or shade, wind, temperature, etc. microclimate.

[7] Contact Banyule City Council's Biodiversity Adviser for a list of plants from that local ecological vegetation community.
[8] This measure aligns with action plan item BP-U5 in the Banyule Biodiversity Plan (p.21)
[9] This measure aligns with action plan item BP-U3
[10] This measure aligns with action plan item BP-U2

Bird Friendly Design	For building works near known migratory routes, consider using the Bird Friendly Building Guide as deemed appropriate by Council's Biodiversity Adviser.
Heat Island Effect Reduction: External Surface Finishes: □ _GS_	**Applies to: projects involving landscaping or roofing changes or additions.** 75% of the total project site area comprises building or landscaping elements that reduce the impact of heat island effect. This includes vegetation, green roofs, light roofing materials and hard-scape, waterbodies and solar PV. *See Green Star Design & As Built (GS D&AB) credit 25.1 Heat Island Effect Reduction.* Provide a submission template for the GS credit to fulfil this guideline.
Outdoor Lighting □ _GS_	**Applies to: projects involving outdoor lighting.** Project must comply with AS 4282 Control of the Obtrusive Effects of Outdoor Lighting and demonstrate that light pollution from outdoor lighting or lighting from internal sources is reduced. No up lighting is permitted. For more details, see *GS D&AB credit 24: Light Pollution,* the Dark Sky Society resource *Good Lights for Good Nights* below, and the *National Light Pollution Guidelines for Wildlife (DoEE 2020)* which specifies lighting standards that minimise impact to nocturnal fauna. 

8.2 Active, inclusive transport

Intent: prioritise modes of human-powered and low-emission vehicles over single driver cars.

Applies to: all projects at sites where people are likely to gather ie. offices, sports and community facilities. See each guideline below for details.

Amenity to Indoor Stairs	**Intent: encourage human-powered movement** Prioritise the amenity to stairs and ramps by ensuring they have access to daylight, views and outside air and/or artwork. *Also see Comfort & Wellbeing - High Quality Amenity Spaces.*
Inclusive access	**Applies to: all projects that include areas which are designed to be used or accessed by the community and/or general staff.** Infrastructure must support all forms of active transport and provide safe, accessible appropriate environments for: • pedestrians and public transport users • wheelchair users • prams and cyclists Note: accessibility coverage in the Australian Standards and the National Construction Code (NCC) should not be assumed to be perfect; such codes and standards tend to have exclusions that may not be in the best interest of the community and/or building users; these include spaces between buildings, facilities, places, for smaller projects, like upgrades, that would improve accessibility but that may not meet the codified 'triggers', and particularly staff support spaces like kitchenettes.

Bicycle Parking Facilities □ _GS_	**Applies to new and refurbished indoor spaces and active open spaces as noted below.** Bicycle use provides environmentally sustainable and equitable access to Banyule's facilities. Convenient and secure bicycle parking is as essential as car parking is for drivers. This guidance recognises that people often have differing needs for bike parking. Employees prioritise safe and secure bike parking over convenience, while visitors want somewhere quick, easy, and convenient to park bikes. In addition, bikes come in varying shapes and sizes including e-bikes, children's, and cargo bikes. Bike parking should be fit-for-purpose, accessible, readily visible and include appropriate signage. **For new and refurbished active open space, ie. sports pavilions, tennis courts, etc less than 499 m²:** • Provision of a minimum of 3 bicycle parking spaces in an accessible location • Where there is existing bike parking, demand for this should be reviewed and facilities increased or upgraded as a result. **For new and refurbished spaces (in buildings or parts of buildings) equal to or greater than 500 m²:** • Covered bike area to accommodate on ground bicycle parking in excess of the relevant Planning Scheme (bike parking for at least at least 7.5% of total regular occupants and 5% of peak visitors) • Only where covered bike parking is not practical, provision of a minimum of 5 bicycle parking spaces in an accessible location is preferred over none. • Visitor parking to be accessible and convenient. Continuous and accessible travel to the bike parking area. If bike parking area is external, access between building and bike parking should be protected from weather.
End-of-trip Facilities	End-of-Trip facilities to have locker ratio of 1.2 per bicycle rack required for best practice. The design of the end-of trip facilities must be appropriate to encourage their use over that of private vehicle use. Therefore, the project team should be able to justify how their location, locker sizes, privacy requirements, and size are conducive to this aim. *See GS D&AB credit 17B.4: Sustainable Transport - Active Transport Facilities.*
Access by Public Transport	Whenever possible, access by public transport should be addressed and highlighted in the design. Measures include preference for an entrance location to be within sight of a designated stop, and signage and maps illustrating the nearby train, tram or bus stops.

Fuel Efficient Transport □ _GS_	• Dedicated parking is to be provided for electric vehicles as well as associated charging infrastructure commensurate to the size of the project. • Allowance for single phase sub-circuits (of 32 Amp capacity) on switch board to allow for e-vehicle recharging for at least 2 stations, or one for every 30 spaces, whichever is greater. • Where appropriate, as a means of future proofing, allowance for at least 1 three phase sub-circuit (80 Amp capacity) to allow for DC fast recharging. *See GS D&AB credit 17B.3 Low Emission Vehicle Infrastructure for details.*
Parking for car share vehicles _GS_	**Intent: vehicular congestion reduction** Parking spaces for car share vehicles must be clearly designated, for example through different coloured line markings and highly visible signage. These parking spaces must be accessible to all car share scheme members. *See GS D&AB credit 17B.3C Parking for Car Share Vehicles for details.*

8.3 Responsible Water Use

Intent: to reduce potable water use while avoiding downstream impacts and pollution.

Applies to: works involving exterior ground or roof surfaces OR those involving water fixtures and/or appliances

Stormwater Management: Ground Surfaces □	Use permeable materials and infiltrate stormwater where possible to reduce site runoff volumes. This would be achieved via incorporating Water Sensitive Urban Design measures and stormwater quality modelling during the design phase. • Target 40% reduction in average annual runoff volumes pre and post development.
Stormwater management: Rainwater Harvesting tanks □ AQUATIC	• Design roof/landscapes and drainage system to maximise the capture and storage of high-quality rainwater. • Rainwater harvesting system to supply toilets, urinals, laundry, garden irrigation, pool top up[11] water, etc. as appropriate. Match roof capture area and tank size to expected use. The Tankulator tool can help size tanks appropriately to expected use. Alternately, Council may wish to request or set up its own water balance calculator based local rainfall data, usage, etc. • Target: Where deemed suitable, capture 100% of the roof runoff.
Stormwater management: Quality □	**Intent: to reduce stormwater runoff volume and improve water quality by replicating the natural hydrology and water balance on the site, with the aim of reducing polluting stormwater runoff into creeks, rivers, coasts and bays.** Stormwater management and Water Sensitive Urban Design (WSUD) measures should be included in drainage design to contribute to landscape design and urban cooling, which helps reduce urban heat island and protect our waterways. • Benchmark: Design the stormwater management system to go 20% 'Beyond Best Practice' stormwater management i.e. 20% above the Urban stormwater best practice environmental management guidelines (BPEMG). This can be demonstrated by either achieving a 120% score in the Melbourne Water STORM tool or MUSIC modelling. • 85% retention of stormwater on a lot, which may require a combination of rainwater tanks and infiltration (non-lined) rain gardens.

[11] AQUATIC Designates guidelines with special consideration for aquatic centres and pools. Other guidelines may also apply to aquatic centres, unless specifically noted otherwise.

Water: Fixtures and fittings □	• Shower heads: 3 star WELS, < 7.5L/min flow rate. • Shower taps: push button time delay variable temperature mixing valve (ie. Enware TFC790925 or approved equivalent). • Toilets: 4 star WELS or 5 star WELS, where a combined handwash cistern may be appropriate. • Urinals: 6 star WELS, sensor operated • Taps: 6 star WELS, sensor operated
Water: Appliances □	• Within one star of Best WELS rating available for its type. • Water efficiency of appliances can be determined by using http://waterrating.gov.vic.au/consumers/index.html (See Equipment section for Energy Ratings) • Commercial appliances often do not have a WELS rating. As such, water usage per wash or cycle should be compared to those that *do* have a WELS rating and documented as part of the project documentation, so as to enable a water balance calculation as appropriate. Alternately, appliances are to meet the standards below for water-consuming appliances, which is from *LEED Building Design and Construction*, Indoor Water Use credit, Table 4. This method option should be subject to

Dishwasher	Undercounter	≤ 6.0 litres/rack
	Stationary, single tank, door	≤ 5.3 litres/rack
	Single tank, conveyor	≤ 3.8 litres/rack
	Multiple tank, conveyor	≤ 3.4 litres/rack
	Flight machine	≤ 680 litres/hour
Food steamer	Batch	≤ 23 litres/hour/pan
	Cook-to-order	≤ 38 litres/hour/pan
Combination oven	Countertop or stand	≤ 13 litres/hour/pan
	Roll-in	≤ 13 litres/hour/pan

8.4 Comfort & Wellbeing

Intent: support occupant comfort, health and wellbeing in indoor environments

Applies to: all regularly occupied interior spaces.

Ergonomic and Active Workstations	**Applies to: all spaces with workstations** • Support Visual Ergonomics *Desktop* computer-based workstations - All desktop computer monitors can be adjusted by height and horizontal distance from the user through one or more of the following: a. Monitors with built-in height adjustment. b. Height-adjustable stands. c. Mounted, adjustable arms that hold primary or additional screens *Laptop* computer-based workstations - All laptop screens can be adjusted by height and horizontal distance from the user through some combination of the following: a. Height-adjustable stands used to raise the laptop screen paired with an external keyboard and mouse that are placed on the work surface. b. Additional monitors provided with one of the following adjustability features: 1. Built-in height adjustment. 2. Height-adjustable stands. 3. Mounted, adjustable arms that hold primary or additional screens • Ensure Desk Height Flexibility. For at least 25% of seated-height workstations, employees have the ability to alternate between sitting or standing through one of the following: a. Adjustable height sit-to-stand desks. b. Desktop height-adjustment stands. • Ensure Seat Flexibility. All seating at workstations for employees meets the following adjustability requirements in compliance with the HFES 100-2007 standard, BIFMA G1-2013 guidelines, or Council approved equivalent: a. Chair height. b. Seat depth. c. One additional adjustability requirement: 1. Seat angle. 2. Backrest angle. 3. Arm rests. *See WELL v2 feature V02 Visual and Physical Ergonomics.*
Cleaning procedures	**Applies to: spaces that where chemical cleaning products are used.** Restrict hazardous or harmful chemicals. See *WELL Health Safety Rating, feature 3 Improve Cleaning Practices.*

Indoor Air Quality (IAQ) _GS_	Ensure the positioning of air intake locations are separated from pollution sources, such as busy roads, parking garages, exhaust vents, etc. *See GS D&AB credit 9.1.1 Entry of Outdoor Pollutants for details.*
Operable Windows	Regularly occupied interior spaces (ie. workplaces) are to include operable windows such that the meet the BESS criteria for effective natural ventilation through cross flow and/or single-sided ventilation[12]. This generally means a maximum breeze path of 15 metres for cross ventilation and a maximum room depth of 5m for single-sided ventilation. Windows that can be opened are to include: • insect screens • reed switches, where the space is conditioned, which ensures that heating, ventilation and air conditioning (HVAC) systems locally shut off when windows are open. *Also see GHG Emissions Reduction - HVAC Controls*.
IAQ: **Outside Air** □	Provide sufficient outdoor air to ensure levels of indoor pollutants are maintained at acceptable levels through an increase in outdoor air or maintaining CO2 concentrations. *See Green Star Credit 9.2: Indoor Air Quality - Provision of Outdoor Air.*
Optimising IAQ and Energy AQUATIC	For spaces that have high heating or cooling requirements, heat recovery ventilation shall be required, with 80-90% minimum heat recovery efficiency.[13] For aquatic centres, and other functions where exhaust air is hot and/or humid, an energy recovery system is to be designed to recover of both latent and sensible heat at optimum rates such as 60%[14], and to utilise it for pool or other heating purposes. See also Energy & Carbon Reduction > HVAC: Ventilation.
IAQ: Low-Emitting Materials □ _GS_	Zero or Low Volatile Organic Compound (VOC) office furnishings, flooring and internal coatings (i.e. paints, adhesives and sealants). *See GS D&AB credit 13.2: Indoor Pollutants - Paints, Adhesives, Sealants and Carpets.*

[12] While the BESS criteria are designed for assessing domestic spaces, the general rules of thumb are also appropriate for other space types.

[13] Heat recovery efficiency values are typically listed as part of mechanical heat recovery ventilation (MHRV) unit's technical specifications. Passive House certified MHRVs are required to have an efficiency of 75% or higher, and a maximum energy demand of 0.45 Wh/m³.

[14] 60% humidity recovery rate found in Passive House subject to annual review or similar.

Assess and Maintain Air Treatment Systems[15] EXISTING	**Intent: to mitigate risks from indoor contamination and pollution sources such as infectious disease particles and VOCs.** Air can be treated to remove contaminants. Carbon filters remove VOCs and ozone from the passing air. HEPA or near-HEPA filters can help remove virus particles. UVGI systems can also be effective, when irradiating the upper portion of the room and/or when placed in the air ducts, so long as they are powerful and/or the air speed is slow enough to provide sufficient UV dose. Project provides an inventory of all filters and UVGI[16] equipment currently used to treat the air in the following locations (if any): a. Ducts and air handling units b. Fan coil units c. Standalone air cleaning devices
Acoustic Comfort □ _GS_	• Internal ambient noise levels in regularly occupied areas are suitable and relevant to the activity type in the room. *See GS D&AB credit 10.1: Acoustic Comfort - Internal Noise Levels.* • Regularly occupied areas are built to reduce the persistence of sound to a level suitable to the activities in the space. *See GS D&AB credit 10.2: Acoustic Comfort - Reverberation.*
High Quality Amenity Spaces □ _GS_	High quality amenity space(s) are to be provided (a general amenity area or, additional breakout space), intended for use by staff or regular occupants, and which meet at least three of the specified criteria for; interaction, ventilation, daylight, views, landscaping and noise. *See Green Star Interiors Credit 14B: Quality of Amenities - Amenity Space Prescriptive Pathway.*
Luminous Comfort: Daylight _GS_ AQUATIC	• Minimum 40% of regularly occupied spaces to comply with Green Star daylight requirements. *See Green Star Credit 12.1: Visual Comfort -Daylight.* If toplighting is used (ie. tubular skylights, light scoops, etc) then *LEED 2009* Daylight hand calculations may be used. • For offices: Operable blinds with VLT ≤ 10% to be provided to North, East and West in occupied spaces. *See Green Star Credit 12.0: Visual Comfort - Glare Reduction: 12.0B Blinds or Screens.* • For pool halls: Shading and daylight to indoor pools is to prevent direct beam sun on the water at all times, so as not to cause glare or otherwise visually obscure view into the pool itself, particularly from the lifeguard area.

[15] This measure is from the WELL Health-Safety Rating for facility operations & management.

[16] Ultraviolet germicidal irradiation is a disinfection method that uses short-wavelength ultraviolet (ultraviolet C or UV-C) light to kill or inactivate microorganisms. UVGI is used in applications such as food, air, and water purification.

Luminous Comfort: Lighting Criteria □	• All luminaires to be LED. • Lighting power density (LPD) target of no greater than 5 W/m² (watts per square metre) average across the building (indoor lighting).
Luminous Comfort: Electric Lighting □ _GS_	• Lighting to have minimum colour rendering index (CRI) of 80. • Lighting with base colour temperature of 4000 Kelvin (+/- 5%) is preferred with alternative lighting temperatures to be considered for certain applications through consultation with Council. • Design lux levels are to target the WorkSafe Guidelines, which area 15% reduction on the recommendations listed in the Australian Standards. • All bare light sources must be fitted with baffles, louvers, translucent diffusers, ceiling design, or other means that obscures the direct light source from all viewing angles of occupants, including looking directly upwards. *Refer GS D&AB credit 11.1.2: Lighting Comfort -Glare Reduction (Option 11.1.2A).*
Luminous Comfort: Electric Lighting in Offices □ _GS_	• For offices: Ceiling area should have an average surface illuminance of at least 30% of the lighting levels on the working plane to improve uniformity of lighting. An average surface reflectance for ceilings of at least 0.75 (corresponds to matte flat white ceiling). *See Green Star Credit 10.2: Lighting Comfort - Surface Illuminance.* Use light interior surfaces and external/internal light shelves to facilitate diffuse light penetration into space. • For offices: If ambient light is below 240 lux (aligning with WorkSafe Guidelines), task lighting providing 200 to 500 lux at the work surface can be used to provide a lighting solution for task based activity areas to reduce bulk lighting requirements. *See WELL v1 Building Standard Feature 53: Visual Lighting Design, Part 1 (c).*

8.5 Energy & Carbon Reduction

Intent: reduce GHG emissions through various means, including energy use avoidance.

Applies to: projects that include components to do with electrical, gas and other energy sources

Refrigerant Management □ _GS_	**Intent: to reduce ozone depletion and direct contributions to climate change by avoiding refrigerant leaks, particularly at the end-of-life when their damage is the greatest.**[17] Applies to: projects that involve any refrigeration or heat pump, or other such equipment that uses a refrigerant. • All naturally occurring or synthetic refrigerants must be zero ODP in composition and manufacture and have a global warming potential (GWP) of less than 10. Natural refrigerants are to always be prioritised over synthetic. • Refrigerant leak detection must be provided for water cooled systems and VRV/VRF systems, unless they are factory-sealed systems (ie. CO2 heat pump hot water systems). Note: until proven otherwise, the precautionary principle should prevail; HFOs[18] or hydrofluoroolefins must be avoided until they are proven to be safe in terms of both environmental and human health.
Compactness AQUATIC	**Applies to: projects with heavily conditioned spaces, where a significant portion (ie. ~35%+) of the building fabric enclosure is constructed or changed.** • Heavily conditioned spaces (ie. pool halls) are to have a compact design, with an area-to-volume ratio to be no more than 0.7 m^2/m^3. • Avoid high ceiling heights for pool halls if possible to save on HVAC costs.

[17] Project Drawdown ranks this measure as #1 based on the total amount of GHG Emissions it can potentially avoid or remove from the atmosphere globally. This guideline is a simplified alignment with Green Star D&AB v1.3 29.1 Refrigerant Impacts and a minor expansion upon the MCC policy.

[18] While HFOs have been promoted as having a low impact on the climate, and marketed under a different name by the chemical industry, they are chemically the same as HFCs, the third generation of destructive chemical refrigerants after CFCs, HCFCs.) See GreenPeace International's HFOs: the New Generation of F-gases.

Separation AQUATIC	**Applies to: buildings with heavily conditioned space adjacent, differently conditioned spaces** Where there are multiple with different types of physical activity – such as learn-to-swim and a lap pool, it is common for such spaces to be heating to different air temperature set points. Where the potential for this exists, the thermal enclosure for the two pools must be separated, so as to avoid air mixing between the two spaces.
Lighting Controls AQUATIC □	**Applies to: projects that involve lighting or lighting controls** • When no Building Management System (BMS; Direct Digital Controller / Programmable Logic Controller) or security access system is required. Lighting control should revert to occupancy (PIR) sensors, as per below. • Lighting to be controlled by BMS or security access system, when BMS is included in project. Integration between lighting and BMS via a Programmable Logic Controller (PLC). • For all common and storage areas include occupancy (PIR) sensors. Avoid the use of complicated and/or proprietary lighting control systems, standalone sensors with remote control programming are preferred. • Sensors to be installed above room entry facing the activity area of the room unless otherwise specified. Sensors not to be positioned to face doorways. • For Class 5 and 9a buildings only, the size of individually switched lighting zones must not exceed 100m². • Pool lighting must be moisture resistant, ie IP67 or IP68 depending on submersion depth.
Equipment Fit Out: Efficiency Standards □ EXISTING	**Applies to: projects that involve electrical appliances or water fixtures.** Equipment used in fit out to be within one star rating of best available technology for energy and water efficiency. ie. refrigerator, freezer, dishwasher (4 star water rating and 3.0 star energy rating or equivalent), oven, cooktop, range hood, hot water urns. Energy efficiency of appliances can be confirmed with performance ratings based on information provided at www.energyrating.gov.au.
Designed building energy use[19]	**Applies to: retrofit and new buildings, except for heavily conditioned spaces.** Exceed National Construction Code (NCC) compliance for energy

[19] This is a modelled pathway for consideration from the EAGA Template Sustainable Buildings Policy. While this item appears simpler than the building fabric guidelines after it, assessing that this is met likely requires more technical expertise; it is also insufficient for energy intensive spaces. Note that if this pathway is accepted as an

	use by a minimum of 40%. Passive design of the building fabric, to include continuous, high levels of insulation, minimal thermal bridging and appropriately sized, high performance windows.[20] This can be demonstrated through review of the intermediate energy modelling results (done for JV3 or GS D&AB credit 15E).
Building Fabric: Thermal Bridge Avoidance & Mitigation AQUATIC	**Intent: to reduce energy use for conditioned spaces and mitigate condensation risk.** **Applies to: works to the building fabric of regularly occupied spaces.** Entire building fabric insulation and construction to meet the following: • Insulation to be continuous as possible, and particularly for energy intensive space types. • Thermal bridge avoidance and mitigation. Both construction and geometric thermal bridges[21] must be: o Identified at all project design hold point ESD reviews o avoided where possible by changing a construction detail or geometry of the conditioned enclosure, or o minimised where avoidance is not an option; thermal bridges must be designed to be 'thermal bridge free' (or $\Psi \leq$ 0.01 W/mK)[22] –particularly important for **heavily conditioned spaces** (ie. pool halls). • Where windows are proposed, the window frame must align with the with the insulation layer of the wall assembly. This also reduces condensation and mould risk.

alternative to the prescriptive building fabric guidelines, prescriptive window specifications for regularly occupied and highly conditions spaces should still be required. The same should be the case for all other criteria such as thermal bridging.

[20] This is based on guidance from the Passive House Construction Standard.

[21] While construction thermal bridges are now addressed for commercial buildings in NCC 2019, geometric thermal bridges have not. More on thermal bridge free construction by Elrond Burrell.

[22] Passive House characterises 'thermal bridge free' as Ψ (psi-value) is no more than 0.01 W/m-K.

Building Fabric: Opaque Components
 	
□
 	
AQUATIC
	Intent: to avoid and/or reduce heating and cooling needs for conditioned spaces
	
	Applies to: works to the building fabric of regularly occupied spaces.
	
	Entire building fabric insulation R-value to be 25% above BCA Deemed-to-Satisfy requirements, or meet the following (particularly for pool halls):
	
	• Exterior walls R2-R3.5, or R3.5-R4 for pool halls
	• Internal walls between **heavily conditioned spaces** (ie. pool halls) and **unconditioned internal spaces**: to be the same as exterior walls, unless a lower R-value is shown to be 'thermal bridge free' and performs better.
	• Internal walls between pool halls and differently conditioned spaces: R2, unless a lower R-value is 'thermal bridge free' and performs better.
	• Ceilings: R 4.0, or R4.6 - R5.1 for **heavily conditioned spaces** (ie. pool halls)
	• Roof surface solar absorbance value to be ≤ 0.4 or higher if possible
	• Floor insulation: required, unless directly above a space that is very similar in terms of space conditioning and schedule.
	  ○ Slab on ground: R1.4, or for pool halls R2 or higher, and slab edge: at least R1.25
	  ○ Suspended floor R 2.5, or R2.8 - R3.5 for pool halls with the slab edge designed to be 'thermal bridge free'.
	
	Independent of R-value requirements all external walls, roofs and lightweight floors must have an approved radiant barrier installed that has a NCC or a NFPA (National Fire Protection Association) flammability rating.

Building Fabric: Glazing Systems □ AQUATIC	**Applies to: works to glazed building fabric elements for regularly occupied spaces** All glazing in conditioned spaces to be *at a minimum* low-E double glazed with thermally enhanced or thermally broken frames and meet the following requirements: • Glazing systems with a maximum (total system) U-value of 2.8, or 2.0 for pool halls and other heavily conditioned spaces. • For projects involving heavily conditioned spaces (such as pool halls), any aluminium window or door frames *must be* thermally broken, and insulating glass units (IGU) with plastic, stainless steel or hybrid (plastic-stainless steel) spacers,[23]. • Glazing systems with a minimum visual light transmittance (VLT) of 0.4. • Unshaded glazing Solar Heat Gain Coefficient (SHGC) <0.4. Pool halls (and other heavily conditioned spaces) must avoid unshaded glazing, except for east facing, winter morning heat gain, provided sun penetration substantially avoids the water surface so as not to obscure view into the pool. Skylights and other horizontal glazing systems are not permitted, however clerestory windows are acceptable, provided they meet the requirements above.

[23] This is based on guidance from the Passive House Construction Standard. For reducing conductive heat transfer, plastic spacers are best, with hybrid stainless steel spaces performing second best. Typically, in double glazing and other insulated glazing units, spacers are made of aluminium, which is a highly conductive material. As such, the spacers – along with the frame and window construction detail – can become the 'weakest link' of the window or glazed door design, particularly when coupled with thermally broken aluminium frames.

Building Fabric: Air Tightness □ AQUATIC EXISTING	**Intent: to reduce the loss of conditioned air through infiltration, and to support the integrity of the building fabric by preventing condensation within wall assemblies.** Applicable to: all regularly occupied conditioned spaces. Building Sealing is a requirement under BCA Section J4 Building Sealing. • Ensure windows and building fabric are well sealed e.g. compression seals on doors and operable windows, taped airtight membranes in building envelope. • Building wrap to be installed in a way that seals the whole wall with connector strips at top and bottom of walls, all joints sealed, and all penetrations sealed to building wrap (including pipes, wiring, windows etc). • All exhaust fans to be fitted with self-sealing dampers. • The building detailing and construction to be capable of achieving a building air tightness test result of less than 5 $m^3/hr/m^2$ @ 50 Pa. Any air tightness testing to be carried out in accordance with ATTMA TSL2 Non-Dwellings – October 2010 standard. • Include air locks (or low-energy revolving doors) with effective functional dimensions for primary entrance into a conditioned space. Locate entrances out of prevailing summer and winter winds, or provide air locks. Air locks are required for access doors associated with pool halls. • Pool halls to have an air change rate up to 4 to 6 ACH (air changes per hour) • For works on existing buildings, air tightness may need to be balanced with increased air movement, ventilation and/or humidity control.
Ceiling Heights □	Ceiling heights to be a minimum of 2.7 metres to enable safe operation of ceiling fans, as well as to aid air movement and ventilation in general. All recreation centres and existing aquatic centres with high ceilings may be provided high-volume low-speed (HVLS) fans, which may be designed to supplement or in lieu of ducted air distribution; this can provide considerable savings in duct and fan motor costs. If included in the design, ensure safe maintenance access to all fans.

Shading and Daylight _GS_ AQUATIC □	• Where there is excessive west-facing glazing, operable external shading options are required. • Vision glazing shading: Fixed devices must be shown to shade the nominated plane, 1.5m in from the viewing façade. The nominated plane must be shown to be shaded from direct sunlight for 80% of the nominated occupied hours for each day of the winter and spring equinoxes and the summer and winter solstices. *See Green Star Credit 12.0: Visual Comfort - Glare Reduction: 12.0A Fixed Shading Devices.* • Minimum 40% of regularly occupied spaces to comply with Green Star daylight requirements. *See Green Star Credit 12.1: Visual Comfort -Daylight*. If toplighting is used (ie. tubular skylights, light scoops, etc.) then *LEED 2009* Daylight hand calculations may be considered in lieu of daylight modelling. • For offices: Operable blinds with VLT ≤ 10% to be provided to North, East and West in occupied spaces. *See Green Star Credit 12.0: Visual Comfort - Glare Reduction: 12.0B Blinds or Screens*. • For pool halls: Shading to indoor pools is to prevent direct beam sun on the water at all times, so as to support clear views into the pool itself.
HVAC & Hot Water □ EXISTING	All building services are electric (no fossil fuels) using efficient heating, cooling and hot water. Where existing gas-based appliances are currently used, develop a replacement plan for when the system needs replacing, such as at the end of its useful life.

HVAC: Technology □	Banyule City Council is moving towards 100% electric buildings and is taking steps to actively reduce and avoid the use of natural gas in building operations. Gas fired heating and hot water solutions will only be considered where required due to operational constraints and will require Director approval. • Heat pump technology for space heating and cooling preferred. Equipment to have Coefficient of Performance (COP) and Energy Efficiency Ratios (EER) within 15% of the most efficient equivalent capacity unit available. • If variable refrigerant flow or volume (VRF/VRV)[24] systems are considered then an analysis should be provided to demonstrate the cost benefit of refrigerant heat recovery. Consultant to ensure equipment can maintain internal temperatures during design summer and winter ambient temperatures. From early planning phases, designers must allow for larger plant associated with high COP outdoor units. • Where refrigerant based equipment is deemed unsuitable due to scale of project, preference is for reverse cycle air-cooled heat pumps. Consultants to provide HVAC selection matrix to justify strategy in relation to project specific requirements.

[24] Note that while VRF/VRV systems typically very energy efficient, they also rely on refrigerants that are high impact in terms of ozone depletion. When incorporated into a project, these systems will require refrigerant management. See Refrigerant Management for more details.

HVAC: Ventilation ☐ AQUATIC EXISTING	**Intent: to optimise the supply outside air for breathing with space heating and cooling requirements to support occupant air quality and thermal comfort.** Applies to: projects that include mechanical, or mixed mode ventilation • If allowed with written Director approval, all natural gas boilers specified to include fully modulating condensing technology at or greater than 96% net efficiency. • Where near-continuous 100% fresh air is required (ie. Gymnasiums), HVAC systems will employ closed loop heat exchange technology (also called heat recovery) with conversion efficiency greater than 75%. Specify maximum heat exchanger pressure drop of 100Pa. Specify low pressure heat recovery bypass (not equivalent to heat recovery pressure drop) for systems over 500 L/s. • All exhaust ventilation systems that operate non-continuously to be fitted with backdraft damper (≤300 L/s) or motorised shutoff damper (> 300 L/s). • For spaces with high and variable occupancy (e.g. auditoriums, gymnasiums etc), provide CO2 control to modulate outdoor air to maintain CO2 concentration of 700ppm. • Ceiling fans shall be considered in any regularly occupied any naturally ventilated, mixed mode and air conditioned spaces to improve occupant thermal comfort and to reduce need to air-conditioning operation requirements where applicable. • For pool halls and other functions where exhaust air is hot and/or humid: energy recovery from air handling unites (AHUs) is to be maximised. Energy recovery system is to be designed to recover of both latent and sensible heat at optimum rates, and to utilise it for pool or other heating purposes. Moisture recovery > 0.6, with humidity-based airflow control required. • For existing pools, add-on energy recovery for exhaust air to balance air quality with energy use reduction, which will help substantially reduce reliance on existing gas heating demand. • For pool halls: air entry points are matched by evenly spaced extraction points around the pools. Note: extraction points around pools should be around 100-200 mm above the pool water level, so as to remove chloramine, a chlorine and ammonia gas mixture which is heavier than air and which is known to build up in chlorinated indoor pools.

HVAC: Economy features	Motorised and fully modulating economy dampers to be fitted to all integrated HVAC systems (packaged or split ducted) with 100% outside air capability.
□	• All Air Handing Unit fans are to include Variable Speed Drive technology capable of being controlled by non-proprietary systems. Fan or pump motors to be direct drive. Belts and pulleys are not to be used. • All heat pumps to employ variable speed / variable refrigerant flow compressors. • Sub-metering to be considered for all central plant items (boilers, domestic hot water, chillers, VRF etc.) with facility for ongoing monitoring of system energy consumption. • For large central plants, consider using low load plant and/or thermal buffer for efficient low load performance and reduced equipment cycling.

HVAC Controls □	All small projects to include proprietary central controller. All large projects to include open protocol Building Management System (BMS). • Where windows can be opened manually (such as in children's centres for inside/outside play), reed switches to be installed to ensure that HVAC systems shut off when windows are open. • Specify occupancy control for small systems (active on, passive off*) unless system is known to operate continuously for 6+ hours per day. • Active on, passive off works on the basis that the system has to be manually started (e.g. push button with run-on timer), but passively deactivated (e.g. motion sensor). • For ducted systems over 20kW, warm-up and pull down cycle to operate in full recirculation based on BMS (where specified) optimised start-up times. • In mixed mode spaces, provide window/door reed switches to deactivate heating and cooling systems (but not supply air) when windows or doors are open. • For large systems, staging of central plant to be optimised using advanced BMS controls or proprietary equipment staging module (e.g. chillers). • Controls strategy to adhere to either PMV/PPD or the Adaptive Comfort Model including restricted temperature control (excluding wet areas and activity rooms) and restricted run time parameters via a direct digital Building Management System (BMS) as applicable.[25] • Split systems other than split ducted (ie cassette, under ceiling) will include proprietary wired wall mounted controllers with administrator lock out capabilities of hi and low temperature, fan speed, run time. Direct occupant control of space temperature is not permitted. Infrared remote controllers (IRCs) are not to be used.

[25] Thermal comfort standards that use these two models include ANSI/ASHRAE Standard 55-2017 and ISO 7730; these models account for both mechanically and naturally ventilated spaces using the PMV/PPD and Adaptive Comfort Models respectively. The standards that apply to mixed mode spaces (aka hybrid ventilated) spaces vary by project. ANSI/ASHRAE Standard 55-2017 or later is recommended, though ASHRAE Standard 55-2013 is also acceptable.

Hot Water □ AQUATIC	Council has a preference for high efficiency electric hot water systems that can link to existing or future solar PV. Facility-specific operational requirements will determine what types of hot water heaters are acceptable for use. • Preference for high efficiency electric hot water heat pumps to be used. Heat pump technology to have a COP within 15% of the most efficient equivalent capacity unit available. • Instantaneous electric systems may be used for remote or in frequent/low-flow uses. • Only if permitted with Director approval, hot water system gas boosters to be high efficiency and employ condensing technology at or greater than 96% net efficiency (including manifolded arrays where staged and/or multiple units are required). • In aquatic centres, hot water systems to integrate into pool hall and pool water heating systems when delivered together. See next section.
Pool Hall and Water Heating AQUATIC ONLY	In aquatic centres, hot water systems to integrate into pool hall and pool water heating systems when delivered together. Hot water and pool hall air heating activities to be derived from electrified technologies. To achieve this, it is recommended that pool hall and water heating: • Is designed by a suitably qualified refrigeration engineer with ≥10 years documented design experience in refrigeration, heat pump systems and HVAC systems. • Be designed to achieve a Specific Energy Consumption (SEC) of no more than *0.20 kWh/m³a (kilowatt hours per cubic metre of per annum) for the pool hall volume*[26]. • Be housed in a suitably sized plant room with appropriate building and health and safety requirements • Is supported by energy recovery from exhaust air • May be supported by heat recovery from waste shower water, depending on the usage.

Pool Filtration Systems
AQUATIC ONLY
	• Filtration systems to use VSD filtration pumps.
	• For large council facilities and high sensitivity facilities, consider:
	  ○ ultra fine filters (UFF)
	  ○ UV and ozone sanitisation
	• Glass pressurised media for smaller facilities

[26] This figure should be reviewed regularly once better information is available on aquatic centre comparative performance.

Pool Blankets AQUATIC ONLY	**Intent: to reduce pool heating demand due to evaporative and conductive heat loss** Applies to: projects involving heated pools • Pool blankets are required, though may be considered optional *only if* the air within the pool hall is be maintained at 65% relative humidity safely without producing condensation or mould risk; this may not be applicable to existing pool halls without energy recovery ventilation and/or an insulated building fabric that avoids thermal bridges. This reduces the evaporative heat loss from the water to the air considerably, but this also requires that thermal bridges are avoided or otherwise addressed. Director approval is required for non-compliance. • Pool blankets to be designed in consultation with operational staff and for ease of use, safety and multi-functionality (ie. designed to become a seat when not in use). • Pool blankets to be deployed and retrieved within *two minutes*. It is recommended they are fixed in an operatable position at high or low level. • An operational procedure must be provided for their use. A short (3-5 minute) audio-visual explanation and sign is preferred. Procedure is to include details of: their benefits, importance and usage instructions
Pipe Insulation □	• Pipe design – both for space planning and on a system level – should have runs that are as short as possible, with an efficient pipe layout and minimum pressure drop. • All hot water piping (flow and return) shall be insulated with pre formed sectional glass wool or polyester insulation in accordance with NCC Specification J5.2c compliance requirements. All exposed pipe work insulation shall be sheathed with 0.5mm thick zinc anneal sheet metal or approved equivalent. All sheathing shall be installed in a manner which resists entry of water and UV light. • All hot water pipes (flow and return) 20mm Outside Diameter (OD) or less shall be fully insulated in accordance with NCC Specification J5.2c compliance requirements. All exposed pipe work insulation shall be sheathed in a UV protective coating, i.e. foil tape or equivalent coating. All sheathing shall be installed in a manner which resists entry of water and UV light. **Note:** Pre-lagged (Kemlag or Polylag) pipe and PEX (or crosslinked polyethylene) hot water pipe is not considered to be insulated in accordance with requirements and must be insulated in accordance with NCC Specification J5.2c.

Hot Water Control Systems
□
	• Ring main hot water systems will include a digital time clock control mechanism that:
	  ○ prevents hot water circulation during non-occupancy hours.
	  ○ starts ring main at least one hour prior (or greater if required for occupational and health and safety requirements) to building occupancy to circulate any accumulated bacteria through 60 °C water to kill any Legionella bacteria.
	• DHW operation to be controlled via BMS or linked to building security access system for smaller projects.

Renewable Energy Systems
□
	• Reduce total peak electricity demand by at least 20% through the installation of on-site renewables.
	• Roof to be designed to maximise the capture of solar energy eg. create unobstructed roof space, ideally pitched towards north and allowing for penetration free anchoring.
	• No structures or roofing element can shade any proposed or existing solar panels.
	• Ensure roof-mounted solar infrastructure is safe and accessible for service and cleaning as required.
	• Provision for the installation of electrical battery storage to be allowed for.
	• The remainder of the energy use to be 100% renewable energy through: [27]
	  ○ onsite storage, like batteries
	  ○ offsite renewable energy via retailing arrangements (i.e. GreenPower, PPA)

[27] from EAGA Template Sustainable Buildings Policy.

8.6 Responsible Materials & Resources

Intent: improve use efficiency and recycling of materials and to avoid waste

Applies to: all projects that use materials and particularly any of those listed below

Concrete _GS_	• 30% minimum cement replacement minimum, with 40% as a stretch target. Other options include using of low carbon concrete, ie. geopolymer or E-Crete. *See GS D&AB credit 19B.1.1: Life Cycle Impacts - Portland Cement Reduction*. • 40% coarse aggregate substitution or 25% fine aggregate substitution. *See GS D&AB credit 19B.1.3: Life Cycle Impacts - Concrete - Aggregates Reduction*. • At least 50% of all mix water for concrete used in the project is non-potable. *See GS D&AB credit 19B.1.2: Concrete - Water Reduction.*
Steel _GS_	• Steel to be sourced from a Responsible Steel Maker in accordance with Green Star Design and As Built guidelines. *See GS D&AB credit 20.1: Responsible Building Materials - Structural and Reinforcing Steel.*
Timber _GS_	• At least 90% of all timber used to be FSC accredited[28] or reused/recycled. *See GS D&AB credit 20.2: Responsible Building Materials - Timber Products.* • The use of tropical hardwoods, ie Merbau, Mirabow, Ipil, Kwila, Vesi are not permitted under any circumstances. • Preference for laminated timber over native structural hardwoods. • All engineered wood products, including office furniture and fit outs to comply with E0 standard for formaldehyde levels. Where no E0 Product is readily available, criteria within the Green Star credit can be applied. *See GS D&AB credit 13.2: Indoor Pollutants - Engineered Wood Products.*
Polyvinyl Chloride (PVC) □	• To reduce environmental and health impacts to building users, internal fitout plastics (eg. vinyl flooring and carpet underlays) must exclude PVC. Where PVC cannot be avoided, apply Best Practice Guidelines for PVC by specifying eco-labels (e.g. Global-Mark Certified) that comply with *GS D&AB credit 20.3 Permanent Formwork, Pipes, Flooring Blinds and Cables*.

[28] This means that projects must source their timber from environmentally responsible forestry schemes. See Green Star Design and As-Built v1.2 or v1.3 Materials credits for more details.

Internal surfaces and finishes _GS_	• Zero or Low VOCs – See Indoor Air Quality: Low-Emitting Materials above. • Plasterboard with recycled content or third party certified plasterboard - *See GS D&AB credit 21: Sustainable Products - (B) Recycled Content Products and (D) Third-Party Certification for further detail.* • Use raw and unfinished surfaces where appropriate.
Other _GS_	• Maximise opportunities for the use of recycled materials & equipment. • Specify durable materials (via manufacturers' warranties) that can be readily recycled at the end of their life cycle. Products/materials with Stewardship Programs will be given preference. *See GS D&AB credit 21: Sustainable Products - (E) Stewardship Programs for further detail.*
Sustainable Products _GS_	Specify building materials that are: reused, contain recycled content, and/or have eco-certification. Preference to be given to locally sourced products. This is to help generate and support markets for recycled materials. *See GS D&AB credit 21.1A Reused Products, 21.1B Recycled Content, 21.1D Third Party Certification.*

8.7 Lifecycle Costs Reduction

Intent: to reduce project life cycle cost – covering both capital and operational expenditure.

Applies to: all projects

Material minimisation	Optimise the size, shape and layout of buildings to reduce costs and materials use.[29] The project is to the respond to the questions below (or similar if deemed appropriate): • What key elements set the minimum size and and/or area of spaces? • List all areas that are deliberately designed larger than necessary for flexibility, and also denote the other use(s) or functions(s) that are the spaces(s) are designed to accommodate.
Resilience and flexibility	Design for long term resilience, adaptability and flexibility. • Where Council determines it appropriate, design for at least a 100-year asset life to greatly reduce lifecycle cost.[30] • Net present value (NPV) is to be used as a capital budgeting method, with recurring energy cost savings calculated as NPV. See 3.4 Assessing Benefits and Lifecycle costs and □ • Rules of thumb for reducing upfront costs
Climate Change Adaptation Plan _GS_	**Applies to: Projects greater than 1000 sqm, and/or which involve vulnerable populations, such as young children or elderly people.** Ensure that climate change impacts and adaptation has been addressed to improve resilience to extreme weather events.[31] For more details on climate change impacts in the region, see Climate Change in Australia - Southern Slopes (Victoria West). A climate change risk assessment will help determine what types of events need to be considered for specific projects. *See GS D&AB credit 3.1 Implementation of a Climate Adaptation Plan for details applying to large developments and precincts*. Note that the Climate Change risk assessment should first be completed for the entire municipality (or larger region of which Banyule is a part of). That information forms the basis of the CCAP, with site and project specific considerations as the added layer.

[29] from the EAGA Template Sustainable Buildings Policy.
[30] from the EAGA Template Sustainable Buildings Policy.
[31] Based on the EAGA Template Sustainable Buildings Policy.

8.8 Management

Intent: to implementing processes and strategies that support positive sustainability outcomes during design, construction and operations.

Applies to: projects involving building services, site demolition or construction

Commissioning & Tuning _GS_ EXISTING	• Establish a service and maintainability review procedure to facilitate design input from the facilities manager and relevant operations staff, and any relevant suppliers and subcontractors (if engaged). *See GS D&AB credit 2.1: Commissioning and Tuning -Services and Maintainability Review.* • Commissioning of HVAC systems to include adherence to ISO 7730 or other Thermal Comfort Standard deemed appropriate by the project team. • An Independent Commissioning Agent (ICA) is required for all Major projects. *See GS D&AB credit 2.4: Independent Commissioning Agent.* • Where an Independent Commissioning Agent is engaged they are to review project compliance with the Banyule ESD Matrix at each project phase. • Where deemed suitable, it is desirable that the Main Contractor has and maintains ISO14001 accreditation. • Where deemed suitable, Construction Indoor Air Quality (IAQ) Plan must be implemented during construction and pre-occupancy phases of a building. The IAQ Plan must meet or exceed the recommended control measures of the *SMACNA IAQ Guidelines for Occupied Buildings under Construction, 2008*; Protect HVAC systems to prevent contamination; and require ductwork to be cleaned prior to occupation or sealed and protected during construction. *See GS D&AB credit 9.1.3: Indoor Air Quality - Ventilation System Attributes - Cleaning Prior to Use and Occupation.* • Quarterly building tuning to be undertaken for at least 12 months following practical completion. *See GS D&AB credit 2.3: Commissioning and Tuning - Building Systems Tuning.* • For **existing buildings**: retro-commissioning and tuning to be considered as part of works involving upgrades to shared or central systems.
Metering & Monitoring _GS_	• Install and/or ensure there is separate accessible metering and zoning for all energy and water common and major uses, including different tenants. *See GS D&AB credit 6.0 Metering.* • All meters and metering systems to be commissioned and validated in accordance with the most current 'Validating Non-Utility Meters for NABERS Ratings' protocol as per *GS D&AB item 6.0.3 Energy Metering Integrity*

	• Enable real time monitoring, with local power points adjacent to switchboards. *See GS D&AB credit 6.1 Monitoring Systems.*
Responsible Construction Practices _GS_	• A comprehensive project-specific best practice Environmental Management Plan must be developed to manage environmental issues from excavation, demolition works construction activities. *See GS D&AB credit 7.0 Construction Environmental Management Plan.* • Divert a minimum of 90% of demolition and construction waste from landfill. *See GS D&AB credit 22B: Construction and Demolition Waste - Percentage Benchmark.* • For large projects, Tenderer and Contractor to illustrate the promotion, program and management of positive culture, mental, physical health for site activities, facilities and site workers and contractors.
Building Information	• Building information is to be made available to bring awareness to sustainability practices and building's footprint with regards to waste, energy, water, transport. *See GS D&AB credit 4.1 Building Information.*
Handover documents	One month prior to practical completion, the builder is to provide a folder of user guides, which as a minimum is to include: • Warranties and specifications of materials and equipment used • Contact person for any defects identified in the Defects Liability Period (DLP) Handover documents to detail the maintenance requirements for all equipment such as Building Management System (BMS), HVAC, water tanks and solar panels to enable plant to operate at peak efficiency. Defect's walkthrough must be carried out with the construction team, Council PM and Building Maintenance.

9 References and Additional Resources

9.1 Banyule City Council Documents

1. Banyule City Council Plan 2017- 2021 – Year 3
2. Banyule's Community Climate Action Plan
3. Banyule's Corporate Emissions Reduction Plan 2020-2023
4. Banyule Planning Scheme 22.05 - Environmentally Sustainable Development

9.2 Sustainable Building Rating tools and other guidelines

5. BREEAM, the UK 'older sibling' to Green Star. (Building Research Establishment Environmental Assessment Method), first published by the Building Research Establishment (BRE) in 1990
6. LEED v4, the US 'older sibling' to Green Star
7. Green Star Design & As Built v1.2 and v1.3. Submission Guidelines and Templates available at: https://www.gbca.org.au/greenstar-manager/resources/
8. Green Star Interiors v1.2 & v1.3. Submission Guidelines and Templates available at: https://www.gbca.org.au/greenstar-manager/resources/
9. Green Star Performance v1.2. Submission Guidelines and Templates available at: https://www.gbca.org.au/greenstar-manager/resources/
10. Living Building Challenge, US based 'advocacy and rating tool', often thought to be the world's most stringent built environment sustainability rating tool. It is freely available for download at: https://living-future.org/lbc
11. Moreland Sustainable Buildings Policy, the 'older sibling' to this document
12. WELL Building Standard, which focuses the health and wellness of building occupants. Available at: https://resources.wellcertified.com/
13. WELL Health-Safety Rating for Facility Operations and Management. Available at: https://resources.wellcertified.com/tools/well-health-safety-rating-guidebook/
14. Passive House Construction Standard.
    Summary form: https://passivehouse-international.org/index.php?page_id=150, or
    Detailed form: Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard
    https://passiv.de/downloads/03_building_criteria_en.pdf
15. EnerPHit Standard – energy retrofits using Passive House principles. See criteria above.
16. Project Drawdown on Building Retrofitting
    https://www.drawdown.org/solutions/building-retrofitting
17. Project Drawdown on Refrigerant Management
    https://www.drawdown.org/solutions/refrigerant-management/technical-summary
18. Guidelines of Good Exterior Lighting Plans, Dark Sky Society:
    http://darkskysociety.org/handouts/LightingPlanGuidelines.pdf

9.3 Aquatic centre related case studies:

19. A Guide for Benchmarking Energy and Indoor Environmental Quality of Aquatic Centre in Victoria, Aquatic and Recreation Victoria and Deakin University 2016.
20. Moreland Council energy efficiency projects - https://www.moreland.vic.gov.au/environment-bins/environment/climate-change/energy-efficiency-projects/
21. Aquatic centre case study: https://www.moreland.vic.gov.au/about-us/projects/recreation-facilities/oak-park-sports-and-aquatic-centre-redevelopment/
22. ammonia refrigerant case study: https://www.mtu.edu/news/stories/2013/january/michigan-tech-ice-rink-goes-green.html
23. Ivanhoe Aquatic Centre Energy Audit by Carbonetix, 16 September 2016
24. Ivanhoe Aquatic Centre Gas to Electric Feasibility by Umow Lai Integral Group 22 April 2020
25. Northcote aquatic and recreation centre, City of Darebin.
26. Passive House inspired Pools – 2 in Germany and 1 in the UK.
27. Energy and water benchmarks for aquatic centres in Victoria, Australia, *Energy and Buildings*, October 2018
28. WaterMarc Energy Efficiency Draft Presentation & Discussion

10 **Definitions/Glossary**

BESS: an online sustainability assessment tool developed by the Council Alliance for a Sustainable Built Environment (CASBE), an alliance of Victorian Councils working to improve the sustainability of the built environment, to assess the sustainability of building projects at the design stage.

BPEM: Best Practice Environmental Management Guidelines for Stormwater – administered by EPA Victoria.

Environmentally Sustainable Design (ESD): Building design that seeks to improve performance, reduce environmental impacts, resource use and waste and create healthy environments for occupants. Also called Sustainable Development or Economic and Environmentally Sustainable Design (EESD)

Fossil Fuels: A fuel (such as coal, oil, or natural gas) formed in the earth from plant or animal remains.

Green Power: Electricity from moving water, wind, the sun, or plant or animal waste, rather than from coal, oil, or gas.

Green Star: Developed by the Green Building Council of Australia (GBCA), buildings can be Green Star certified for the environmental sustainability of their construction (Design and As-Built tool); fit outs (Interiors tool) and their operational performance (Performance tool). Buildings are accredited through an assessment by a third party and can achieve between a 4-6 star accreditation.

Independent Commissioning Agent (ICA): A role that can be filled by one or more people who are appointed by, and report directly to, Council. They are independent of any contractor, sub-contractor or consultant who has been involved in the design or installation of the nominated building systems. They are a registered professional engineer or qualified technician with demonstrated knowledge on mechanical, electrical, hydraulic and ESD systems commissioning.

Integrated Water Management (IWM) and Water Sensitive Urban Design (WSUD): A holistic approach to water management that integrates urban design and planning with social and physical sciences in order to deliver water services and protect aquatic environments in an urban setting. A WSUD approach could include the integration of raingardens, infiltration, water harvesting and wetlands in an urban area to manage stormwater.

LED: 'Light Emitting Diode', a form of energy efficient lighting.

Lifecycle cost: The total cost of an asset throughout its useful life taking account of the planning, design, construction, acquisition, operational, maintenance, rehabilitation, and disposal costs.

NCC: National Construction Code

PPA: Power Purchasing Agreement

Thermal bridges: locations where insulation continuity is reduced or otherwise compromised, allowing for greater heat loss as compared to the areas adjacent. For example, thermal breaks must be included where steel framing is used.

11 Associated Documents

Banyule Sustainable Buildings Matrix – Excel spreadsheet – Refer to D21/121895