Sustainability Management Plan

The Factory | 35-45 Lithgow Street | Model

V1 | 29 October 2025

ARUP

Document Verification

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Introduction

Strategy Overview

Regenerative decarbonisation for build-to-rent

This report provides an overview of the Sustainability Management Plan for Model's multi-residential development at 35-45 Lithgow Street, Abbotsford.

Arup has developed a sustainability strategy for this project with Model and the project team which takes a holistic approach with consideration of emerging market expectations for sustainable buildings.

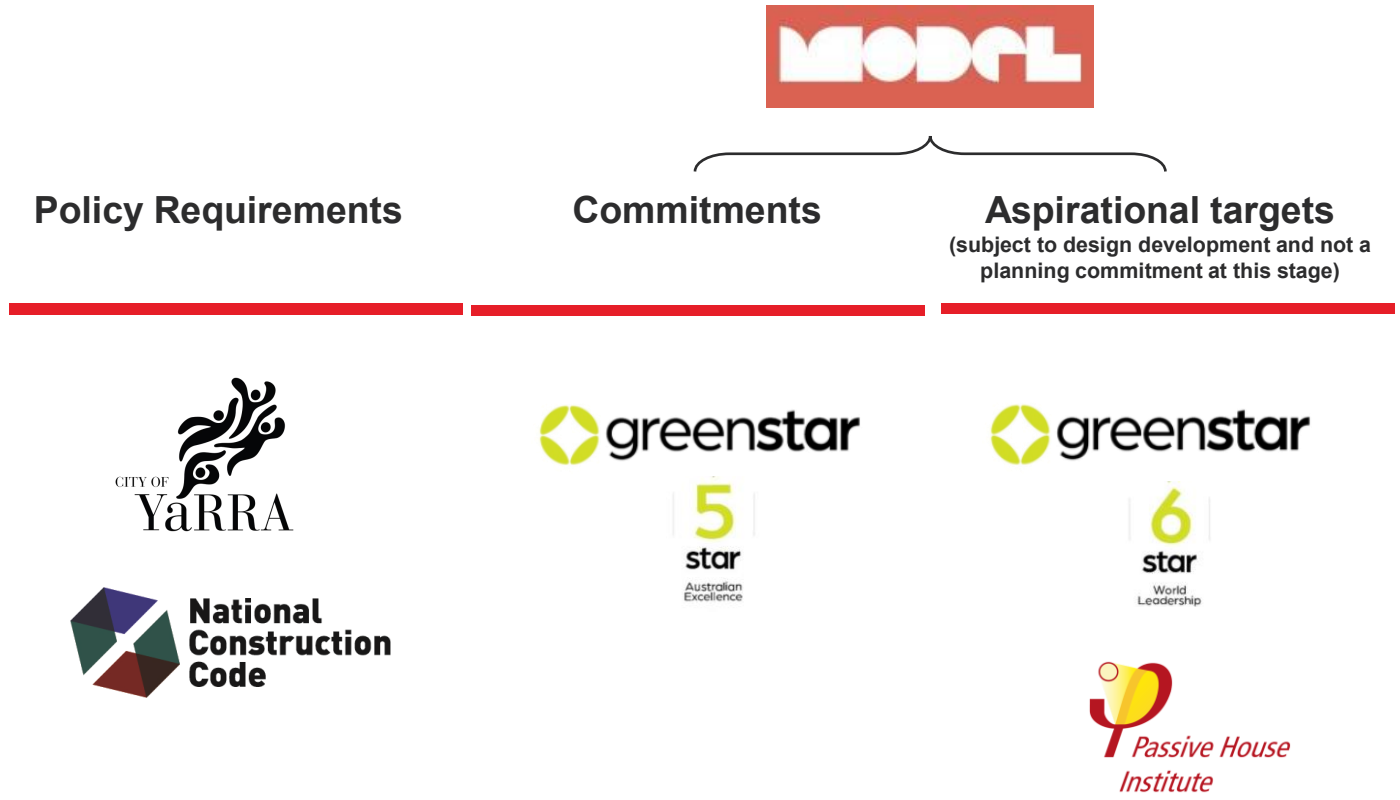
An overview of Yarra City Council's applicable requirements for the development has been outlined and is directly addressed within this report based on the proposed design.

The project is committed to achieving the following minimum requirements, aligning to City of Yarra's current policy expectation:

- 5 star Green Star, including
- 7 star NatHERS average and 6 star minimum, or equivalent

Additionally, Model are pursuing the following targets subject to detailed design resolution. Note these are not commitments for planning purposes at this stage. This includes:

- 6 star Green Star
- Passivhaus Classic certification
- 9 star NatHERS average or equivalent



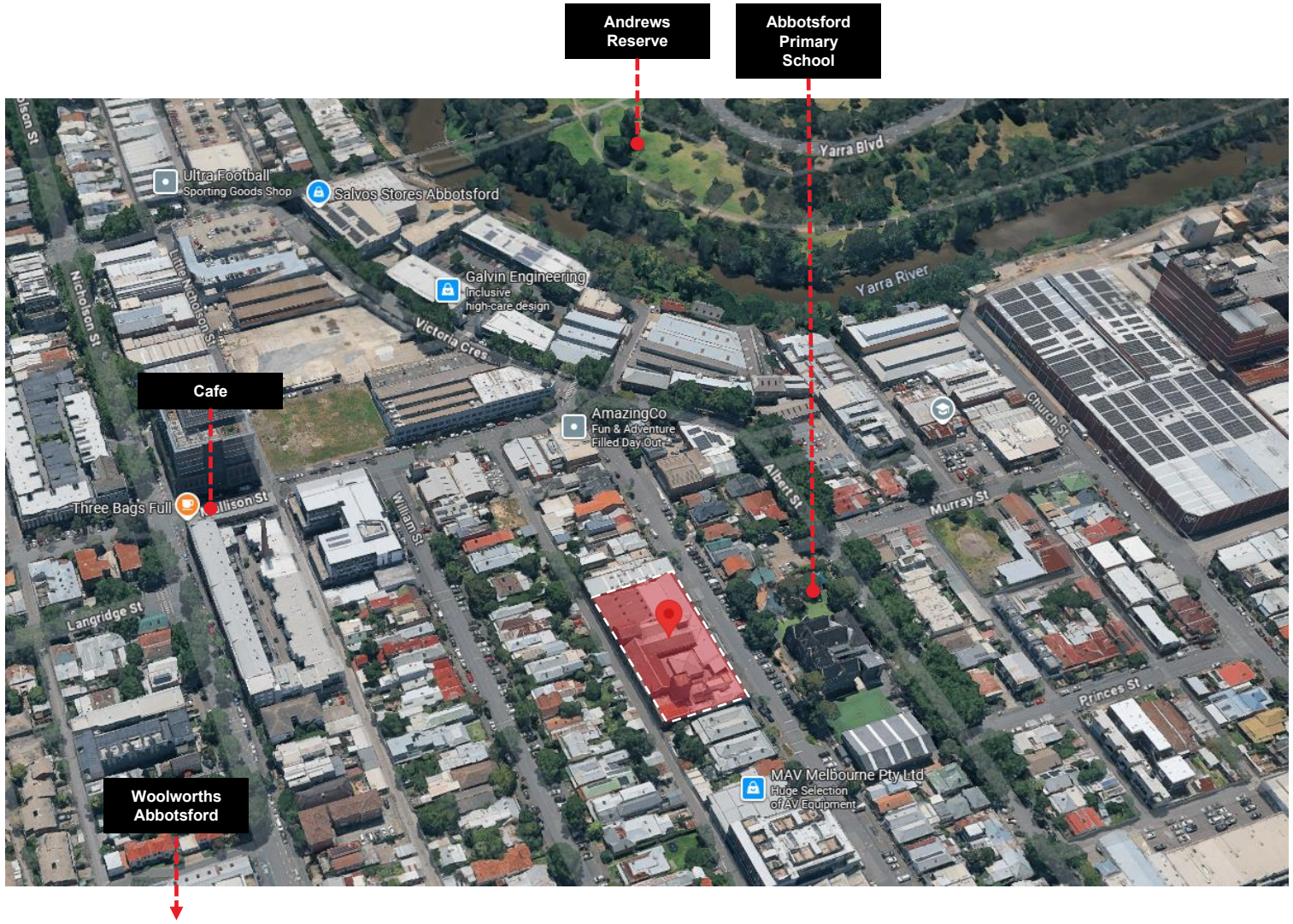
Project requirements, commitments and aspirational targets

Site Context

Inner Melbourne

The proposed development is located at 35-45 Lithgow Street, Abbotsford, under 5 km east of Melbourne CBD. Abbotsford is rapidly changing towards higher-density living, which support's the areas transformation from industrial to residential. Supporting this transition includes:

- Education facilities such as Abbotsford Primary School and childcare centres
- The site has a Walk Score of 96 and a Transit Score of 82, indicating good accessibility to transport amenity and safe, walkable streets.
- The site is a 5-minute walk from two tram line stops that run from Box Hill towards Melbourne's CBD and from Victoria Gardens to St Kilda. These connect the site to both rapidly growing eastern suburbs as well as the city centre.
- The location is nearby multiple parks as well as the Yarra river and adjacent reserves.



35-45 Lithgow Street Context

Nearby neighbourhood, parks and amenity (GoogleEarth)

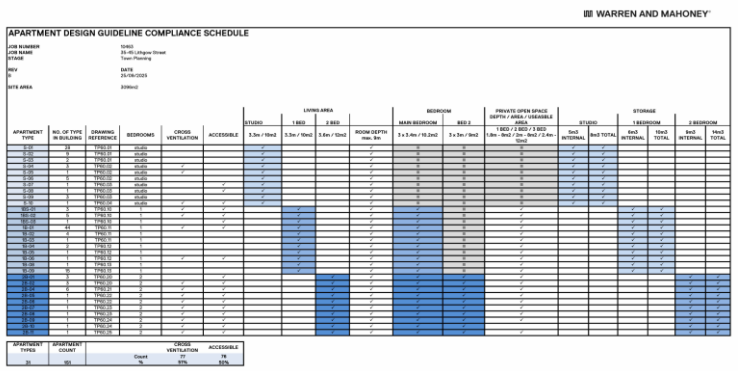
Project Overview

Medium density high performance living

The 35-45 Lithgow Street development is an ambitious build-to-rent project by Model with Warren and Mahoney Architects, comprising of 151 apartments across the 3,096 m^2 site. It will replace the site of the old Schweppes Cordial Factory in Abbotsford and is retaining an existing building to be repurposed for shared amenities such as co-working, wellness spaces and retail.

The project is committed to achieving Green Star 5 Star with the latest Buildings v1 tool and is also pursuing a 6 Star Green Star and Passivhaus Classic certification subject to design development. It is also pursuing the following initiatives to support Model's aim to decarbonise housing at scale:

- 7 star NatHERS average and 6 star minimum (or equivalent).
- 70 kW solar PV array (or sufficient to meet Green Star best practice requirements)
- Low carbon materials with at least a 20% reduction in upfront carbon.
- Well located near both trams, trains and bike paths.
- Bike parking for ~40% residents to encourage active transport.
- Communal and landscapes spaces provided to facilitate health, wellbeing and connection among residents.

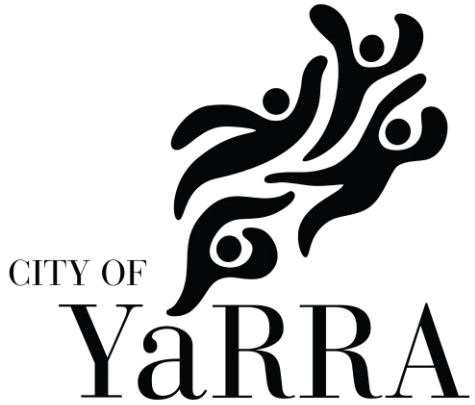


35-45 Lithgow Street Development Summary

35-45 Lithgow Street Ground floor plan

35-45 Lithgow Street East Elevation

Policy Review and Strategy



City of Yarra Planning Policy

Clause 15.01-2L Environmentally Sustainable Development

Clause 15.01-2L-01 Environmentally sustainable development of the City of Yarra Planning Scheme has several performance measures pertaining to sustainable building design for this type of building (Residential, ten or more dwellings).

All Yarra City Council ESD objectives are being met and exceeded by the proposed development at 35-45 Lithgow Street to meet current and emerging expectations for sustainability.

The table inset summarises the requirements and the project's responses. This is expanded upon in the following pages and documented within this report.

Current City of Yarra Planning Policy

Clause 15.01.2L-01 Extract

Council ESD Objectives	35-45 Lithgow Street Response
Energy Performance	• Minimum 7 star NatHERS average and 6 star minimum, or equivalent, with 9 star average stretch target • Provision of ~70 kW solar PV array to generate renewable energy on-site • All-electric design with electric heat pump with a COP of at least 3.0 for domestic hot water • Air permeability target of <5m^3/m^2/hr @50Pa, aligned with Australian best practice
Integrated water Management	• Water efficient fixtures and fittings to reduce potable water consumption • 20 kL rainwater tank installed to collect and reuse rainwater in irrigation and toilet flushing in apartments • Native and indigenous planting to reduce irrigation requirements • Targeting minimum 10% reduction in potable water use overall
Indoor Environment Quality	• Passive design measures to enhance thermal comfort without active heating and cooling, such as a high-performance building envelope and moderate glazing area, combined with external shading where required. • Provision of ceiling fans. • Low VOC materials used for a healthy indoor environment • Acoustic design to manage internal noise levels and provide acoustic separation.
Transport	• 90 bike hoops for residents and 6 for visitors • 3 electric vehicle charging spaces and 100% remaining car spaces will have capability to be upgraded to electric charging spaces in the future subject to fire risk.
Waste Management	• Multiple waste streams collected including waste to landfill, commingled recycling, glass, organics, hard-rubbish storage, e-waste bin and charity waste bin. • Diverting 90% of construction and demolition waste from landfill
Urban Ecology	• >700m^2 green space provided– with a significant tree (or equivalent) for nesting to enhance biodiversity and mitigate urban heat island effects. • 60% indigenous planting to promote local flora and fauna.
Innovation	• Climate resilience strategy implemented • Biophilic principles incorporated in the building design • Targeting 20% reduction in upfront carbon through efficient design and use of low carbon materials

Overall Sustainability

Mandatory

The Yarra City Council planning scheme requires a sustainability assessment under either the BESS or Green Star framework for residential developments with more than 10 dwellings (Clause 15.01-2L-01).

Model is targeting a 5-star Green Star rating for the 35-45 Lithgow Street project using the latest *Green Star Buildings v1* tool, which is considered to represent Australian Excellence in sustainability leadership. The project is also pursuing a stretch target of 6 star Green Star which will be confirmed as the design develops.

Green Star is Australia's national, voluntary rating system for the sustainable design, construction, and operation of buildings, fit-outs, and communities. The *Green Star Buildings v1* tool is the most ambitious version to date, setting minimum expectations and offering a comprehensive set of credits across environmental, social, and governance themes.

In parallel, the project is pursuing a Passivhaus Classic rating, however, this is pending further development and certification target will be confirmed as the design develops. This is a global best practice rating tool that is an extremely effective mechanism for achieving a high-performance building. It focuses on key targets for maximum heating and cooling demands, primary energy demands, humidity, airtightness and condensation minimisation.

The focus of this report is on demonstrating alignment with the *Green Star Buildings v1* framework, which is the current certification pathway for 35-45 Lithgow Street.

35-45 Lithgow Street is committed to achieving:

- 5 star *Green Star Buildings v1* rating, with 35 points targeted - exceeding planning requirements

Additionally, the following is being pursued, but is provisional and does not form part of the planning commitment at this stage:

- 6 star *Green Star Buildings v1* rating, with 70 points targeted
- A *Passivhaus Classic* rating for the apartment buildings – this aligns with several Green Star Credits and can expect to contribute to Exceptional Performance for energy use.

Model is committed to registering the project in early 2026 before the cut-off date for the v1.1 update.

CITY OF YARRA

Requires assessment using either:

bess OR greenstar

Overall Sustainability

Mandatory

Model is pursuing a 5 star Green Star Rating for the 35-45 Lithgow Street project and as such is required to meet the energy performance as dictated by the Green Star Credit Achievement Criteria.

Additionally, the project must not exceed minimum cooling load limits as outlined by the Apartment Design Guidelines Victoria (ADGV) whilst also meeting the NCC 2022 criteria (minimum 7-Star average).

Therefore, the following targets have been adopted for the project:

- ✓ 7 star average or equivalent which equates to ~62 MJ/m^2/year heating and cooling energy demand, and 6 star minimum for each apartment or *equivalent using J1P2.*
- ✓ Cooling load to not exceed 41 MJ/m^2 as required for NatHERS climate zone 21 (ADGV).
- ✓ Whole of home average score of at least 50 out of 100 *or equivalent using J1P3.*

Preliminary NCC NatHERS modeling, supporting this performance, is included in Appendix A for a selection of representative apartments.

Non-residential areas must also achieve improvement beyond code requirements, and a target 20% improvement on Section J DtS has been adopted to align with the Green Star Energy Use credit.

Australian Government

NCC 2022

J1V5 performance verification method

J1P2

≈ 7 star NatHERS

≈ 62 MJ/m^2

(max. heating + cooling demand for all units, note superseded)

J1P3

Whole of home energy usage

(Less than a reference building)

+

VICTORIA State Government

ADGV

Australian Design Guidelines Victoria

< 41 MJ/m^2

(cooling demand – use of J1V5 method proposed for all units)

[No mention of stars or whole of home]

+

CITY OF YaRRA

5 Star

Green Star

≈ 7 star NatHERS

≈ 62 MJ/m^2

(Target and use of J1V5 requires TQ with GBCA for all units)

[No mention of whole of home]

Energy Performance

Discretionary

The project must implement design measures to reduce both energy use and energy peak demand. In addition to mandatory NCC energy efficiency requirements, renewable technologies such as onsite solar PV are strongly encouraged where possible.

Onsite renewables increase a buildings resilience against black outs or brown outs. They have the additional benefit of reducing stresses on land use for offsite generation farms that can have negative consequences for ecology and biodiversity on the site they are developed.

These recommendations align with credit 22 Energy Use, where projects are encouraged to provide a minimum 500 kWh of annual electricity generation per dwelling through on-site solar PV.

- ✓ A 70 kW solar PV array will be installed on rooftops of the buildings, which has been sized based on Green Star best practice energy requirements. Refer Appendix B for further information.
- ✓ 35-45 Lithgow Street is committed to achieving these requirements with all an efficient, all electric design.
- ✓ Model will source 100% renewable energy for all residential common area energy uses

Indoor Environment Quality

Mandatory

The project must achieve a healthy indoor environment quality, including thermal comfort and access to fresh air and daylight, prioritising passive design over mechanical heating, ventilation, cooling and lighting.

- ✓ The project has been designed to achieve an average NatHERS star rating of 7, which is beyond current NCC requirements and will facilitate enhanced thermal comfort through passive design measures including a high-quality building fabric and external shading. Refer Appendix A for the design specification.
- ✓ The project ensures that regularly occupied spaces are nearby glazed façades or windows, enhancing access natural light and external views of nature and greenery.
- ✓ An initial daylight review shows the apartments at 35-45 Lithgow Street receive good levels of daylight, with windows to all living and bedrooms and room depths less than 9m. Refer Appendix D for preliminary daylight assessment.

Mandatory Cont.

The project must reduce air pollutants by encouraging use of low-toxicity materials. The project must also minimise noise levels and noise transfer within and between buildings and associated external areas.

These requirement align with Green Star credits 13 Exposure to toxins and 12 Acoustic Comfort.

- ✓ The project is committed to using low VOC paints, adhesives, sealants, carpets and engineered wood products.
- ✓ The project will provide acoustic comfort for building residents through design of internal noise levels and providing acoustic separation. This will be developed during detailed design.

Urban Ecology

Mandatory

The project should protect and enhance biodiversity by incorporating natural habitats and planting indigenous vegetation. Urban heat island effects should be mitigated through building design, landscape design, water sensitive urban design and the retention and provision of canopy and significant trees.

These requirements align with Green Star credits 36 Biodiversity Enhancement and credit 19 Heat Resilience.

- ✓ >700 m^2 of green space is present throughout the 35-45 Lithgow Street development, and 60% of plants will be native and indigenous species. Over 30 trees will be planted on-site, including one large nesting tree or equivalent. Refer Appendix E for a summary of landscaping on-site.
- ✓ Urban heat island effects will be mitigated through strategies such as greenery and landscaping, and low reflectance paving to more than 75% of the whole site area. Refer Appendix F for more information.

Discretionary

Space for productive gardens is encouraged, particularly in larger residential developments.

- ✓ 35-45 Lithgow Street will include a productive garden area for residents to grow herbs and vegetables on the rooftop.

Transport

Mandatory

The development should promote the use of walking, cycling and public transport and minimise car dependency.

These requirements align with Green Star credit 27 Movement and Place.

- ✓ The project will include 90 bicycle parks for residents and staff, as well as 6 visitor bicycle parks, informed by the Sustainable Transport Plan.

Refer Appendix G for the Green Star Transport calculation.

Discretionary

Promote the use of low emissions vehicle technologies and supporting infrastructure.

- ✓ 35-45 Lithgow Street will include 3 electric vehicle charging spaces representing 5% of the total number of cars. It also includes provision for 100% of the remaining carparks to be fitted with EV charging capability in the future subject to fire safety.

Further information is included in Appendix G.

Waste Management

Mandatory

The project should avoid waste to landfill and prioritise reuse and recycling during the design, construction and operation stages of development. Sufficient space should be allocated for future change in waste management needs, including (where possible) composting and green waste facilities.

These requirements align with Green Star credit 2 Responsible construction and credit 4 Responsible Resource Management.

- ✓ 35-45 Lithgow Street is committed to diverting 90% of construction and demolition waste from landfill
- ✓ The project will retain the heritage façade and will also retrofit an existing building, including non-heritage elements to house amenities and retail.
- ✓ The building is designed for the collection and separation of multiple waste streams including waste to landfill, commingled recycling, glass, organics, e-waste, charity waste bin and hard rubbish storage.

Discretionary

The project should encourage the use of durable and reuseable building materials.

- ✓ Low carbon, durable and reusable materials are to be prioritised and further developed during detail design. Initial information on materials can be found in Appendix H.

Integrated Water Management

Mandatory

The project must reduce total operating potable water use through appropriate design measures such as water efficient fixtures, appliances, equipment, irrigation and landscaping. Additionally, best practice water sensitive urban design mechanism must be incorporated to improve the quality of stormwater runoff and reduce impacts on water systems and water bodies.

These requirements align with Green Star credits 25 Water Use and Credit 39 Waterway protection.

- ✓ The project is targeting a minimum 10% reduction in potable water use compared to a hypothetical reference building. This will be achieved through the installation of water efficient fixtures and fittings and the collection and reuse of rainwater for toilet flushing and landscape irrigation. Refer Appendix B for further information.
- ✓ Stormwater discharge will be reduced by at least 40% across the site and pollution managed. Refer submission Stormwater Report for further information.

Discretionary

Alternative water sources such a greywater, rainwater and stormwater are encouraged.

- ✓ The 35-45 Lithgow Street project has allowed for a combined 20 kL rainwater system to meet this requirement with water treatment considered not commercially viable at this scale.

Innovation

Further sustainability commitment

The City of Yarra does not mandate the inclusion of additional innovative initiatives, however Model endeavor to commit to several further sustainable outcomes for the 35-45 Lithgow Street project.

The project is pursuing the following initiatives that go beyond council requirements. These have been adopted to align with Model's sustainability ambitions, as part of the developments 5 Star Green Star pathway.

- ✓ 20% reduction in upfront carbon, through the adoption of low carbon materials and efficient design strategies. This will be further developed in subsequent project stages. Refer Appendix H for further information.
- ✓ A climate resilience strategy will be prepared for the development, following a workshop with the project team in the next project phase. We have undertaken a climate pre-screening to identify key risks. Refer Appendix J for further information on risks identified.
- ✓ Biophilic design principles have been adopted in the design and will be further developed as the design progresses. The project is committed to achieving Green Star credit 15 Connection to Nature. Refer Appendix E for further information.

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Green Star Pathway

greenstar

Strategy Overview

Driven by 5 star Green Star target

The 35-45 Lithgow Street development is committed to achieving a 5 star Green Star rating for the building, indicating a level of 'Australian Excellence'. Based on the current design, however, the project is well placed to achieve its aspirational pursuit of a 6 Star "World Leadership" rating.

This requires a minimum of 35 credits in the Green Star Buildings v1 Submission (5 star) or 70 points (6 star).

This exceeds the current policy requirement for a Green Star rating or BESS assessment.

It should be noted that the specific credits that are targeted may change throughout the course of the project as final design is detailed and construction documentation is provided, however the project is committed to the overall goal of a 5 star Green Star rating.

The Green Star pathway to achieve a 5 star rating is outlined in further detail within the following pages.

Responsible

Recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner.

Healthy

Promotes actions and solutions that improve the physical and mental health of occupants.

Resilient

Encourages solutions that address the capacity of the building to bounce back from short-term shocks and long-term stresses

Positive

Encourages a positive contribution to key environmental issues of carbon, water, and the impact of materials.

Places

Supports the creation of safe, enjoyable, integrated, and comfortable places.

People

Encourages solutions that address the social health of the community.

Nature

Encourages active connections between people and nature and rewards creating biodiverse green spaces in cities.

Leadership

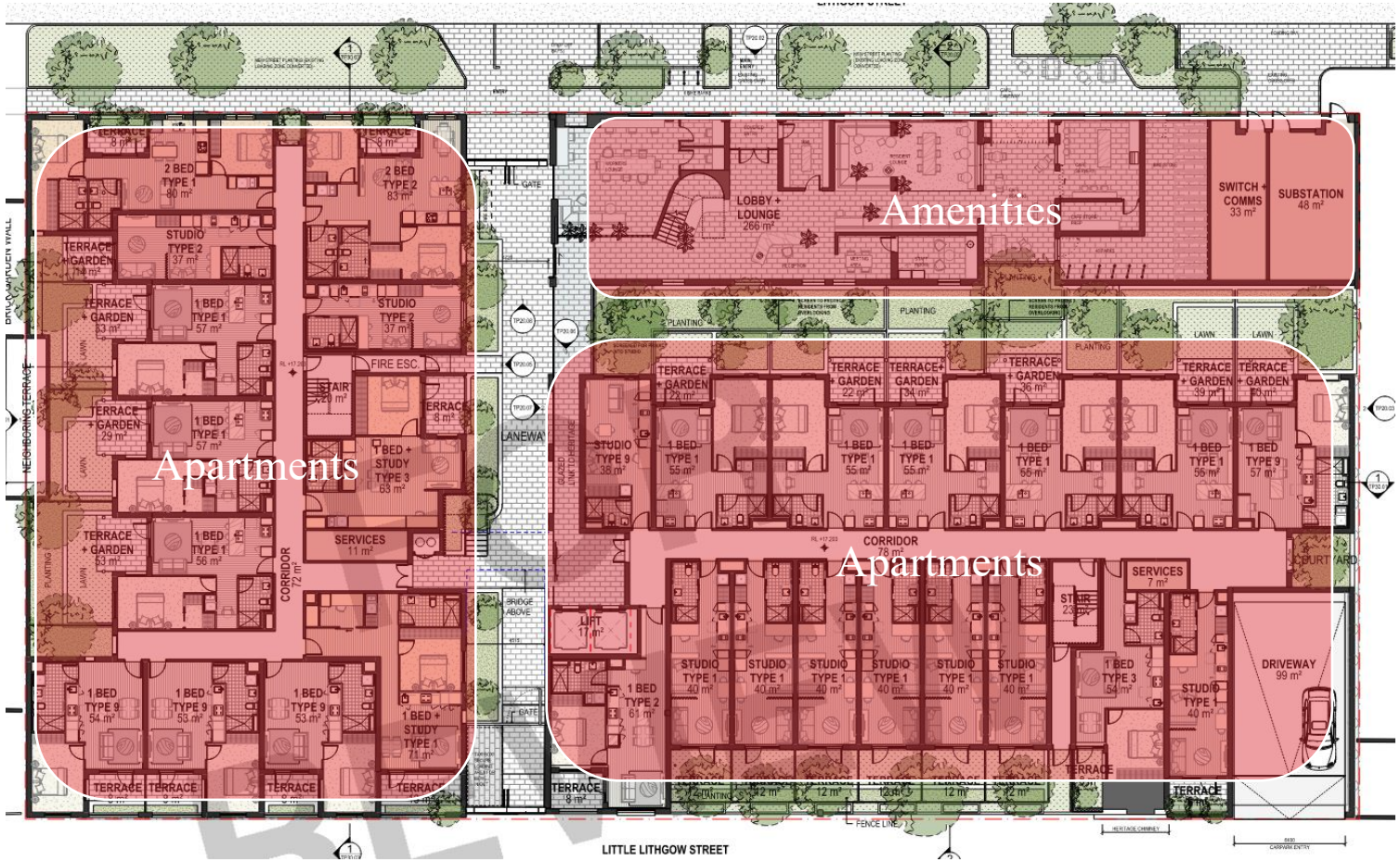
Recognises projects that set a strategic direction, build a vision for industry, or enhance the industry's capacity to innovate.

Green Star Approach

5 star Green Star for whole development

The 35-45 Lithgow Street development encompasses three forms connected by a shared basement and multiple above-ground bridges. All apartments are contained within two of the building forms, with the third form housing all residential amenities and retail.

The development is considered one Green Star Buildings v1 rating and will be assessed holistically.



Ground floor plan, WAM

Responsible

6/17 Green Star points

Recognises activities that ensure the building is designed, procured, built, and handed over in a responsible manner.

The Responsible category in Green Star encourages implementation of practices that support best practice outcomes throughout the different phases of planning, design, procurement, construction, commissioning and operation of a development.

1 **Industry Development** — **Credit Achievement 1/1**

Arup as a Green Star Accredited Professional (GSAP) has been contractually engaged to provide advice, support and information related to Green Star principles, structure, timing and processes, at all stages of the project, leading to certification. The project will also track the cost and market the sustainability outcomes.

2 **Responsible Construction** — **Credit Achievement 1/1**

The project team has committed to set, measure and report on its environmental performance through the implementation of a project specific EMP. The performance shall be reported on quarterly, with methods appropriate for each stakeholder group. The contractor will provide sustainability training to site workers. At least 90% of the waste generated during construction and demolition will be diverted from landfill.

3 **Verification + Handover** — **Credit Achievement 1/1**

The project is committed to achieve various energy, water and indoor environment targets in line with Green Star certification. The project will conduct an airtightness test, be commissioned and tuned as well as deliver comprehensive operations and maintenance documentation at the time of handover. An independent commissioning agent will be engaged to monitor these processes and documentation.

4 **Responsible Resource Management** — **Minimum req.**

The building will be appropriately designed to facilitate the separation and collection of waste and resource streams, including appropriately sized storage areas and safe and efficient access for occupants and collection contractors. This is consistent with the operational waste management plan prepared.

5 **Responsible Procurement** — **Credit Achievement 1/1**

The project will follow ISO 20400 Sustainable Procurement – Guidance by undertaking a risk and opportunities assessment in design development. A responsible procurement plan will be developed to help implement opportunities and mitigate risks and will inform material specification.

6 **Responsible Structure** — **Not targeted**

Not targeted at this stage.

7 **Responsible Envelope** — **Not targeted**

Not targeted at this stage.

8 **Responsible Systems** — **Not targeted**

Not targeted at this stage.

9 **Responsible Finishes** — **Exceptional Performance 2/2**

The project will specify internal building finishes that meet responsible sourcing and procurement requirements. Such as FSC certification for timber finishes and third party eco-labels for carpets, ceilings, partitions etc such as GECA, GreenTag and Declare with EPDs. This strategy will be defined as the design develops in detail to inform material specifications.

Healthy

10/14 Green Star points

Promotes actions and solutions that improve the physical and mental health of occupants.

We spend the majority of our time indoors so the quality of the indoor environment is crucial for our health and wellbeing and the Heathy category aims to ensure buildings facilitate a healthy environment. Occupant wellbeing may also by supported by having access to nature and natural amenity such as daylight.

10 **Clean Air** — **Credit Achievement 2/2**

A higher level of fresh air (50% more) is provided to ensure levels of indoor pollutants are maintained at acceptable levels. The project will provide mechanical ventilation to meet this target. This can also be considered with 700ppm criteria, with continuous CO_2 measurement and dynamic control of the ventilation system to maintain levels under this limit. Minimum separation distances between supply intake and exhaust are met and internal sources of pollutants are exhausted directly outside.

11 **Light Quality** — **Minimum Req.**

The building provides access to a view and daylight to all the apartments. Some lower-level apartments have limited access to daylight due to overshadowing; however all regularly occupied areas are near windows and residents have access to outdoor areas as well as indoor amenity areas with excellent levels of daylight. Refer to preliminary daylight assessment in Appendix D.

12 **Acoustic Comfort** — **Credit Achievement 2/2**

The buildings will be designed to meet high levels of acoustic comfort, by using appropriate finishes to reduce reverberation, acoustically insulated partitions to separate spaces and reduce the intrusion of external noise with appropriate envelope. This will be detailed as the design develops and tested upon completion.

13 **Exposure to Toxins** — **Credit Achievement 2/2**

95% of paints, adhesives, sealants and carpets will be specified to meet strict VOC content and 95% of engineered wood products must meet thresholds for formaldehyde. This strategy will be defined as the design develops in detail to inform material specifications and tested upon completion.

14 **Amenity and Comfort** — **Credit Achievement 2/2**

The project will include dedicated spaces that act as relaxation areas. The design presently features an array of spaces for dedicated amenity areas for occupants to meet this requirement. Please refer to marked up plans in appendix D.

15 **Connection to Nature** — **Exceptional Performance 2/2**

The building will include indoor plants and incorporate nature-inspired design through the integration of the tenant fit-out and detailed design of the lobby space. At least ~1m^2 of indoor plants to every 300m^2 of regularly occupied spaces (~80% GFA) will be provided. The design presently features ~30m^2 of indoor plants including indoor/outdoor spa with landscaping.

Resilient

2/8 Green Star points

Encourages solutions that address the capacity of the building to bounce back from short-term shocks and long-term stresses.

The Resilient category addresses the need for developments to have defences and mechanisms in place to respond to and mitigate changes in climate, supporting infrastructure and in emergency scenarios.

16 **Climate Change Resilience** — **Credit Achievement 1/1**

The project will develop a project-specific climate change risk and adaptation plan for the building. All the high and extreme risks must be addressed with design or operational interventions. A pre-screening check has been undertaken and is included in Appendix J. The detailed strategy will be defined as the design develops in detail which is appropriate given the limited findings from the pre-screening exercise.

17 **Operations Resilience** — **Not Targeted**

The operations resilience strategy is not being pursued on this development at this stage but may be reviewed as the design develops to understand the project opportunities further.

18 **Community Resilience** — **Not Targeted**

The community resilience strategy is not being pursued on this development at this stage but may be reviewed as the design develops to understand the project opportunities further.

19 **Heat Resilience** — **Credit Achievement 1/1**

Strategies will be implemented to reduce the project's contribution to the urban heat island effect by including light shade finishes, vegetation and shading. The design presently features light coloured roofs and vegetation to meet this requirement. Please refer to marked up plans in appendix F.

20 **Grid Resilience** — **Not Targeted**

This credit is not targeted at this stage but will continue to be investigated with the project team as the design develops in case the criteria becomes of interest to the project.

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Positive

19/30 Green Star points

Encourages a positive contribution to key environmental issues of carbon, water, and the impact of materials.

Promotes actions and solutions that improve the physical and mental health of occupants.

21 **Upfront Carbon Emissions** — **Credit Achievement 3/6**

The building's upfront carbon emissions are at least 20% less than those of a reference building. This will be tested on the basis of the reference design defined by Green Star. A preliminary analysis has been undertaken and is included in Appendix C with various proposed strategies including existing building reuse, structural design optimisation and other low carbon products including ceiling panels with EPDs. This will be further explored in the next design stages.

22 **Energy Use** — **Credit Achievement 3/6**

The building's energy use will be reduced through adopting at least a 7 star NatHERS average rating. This will be demonstrated by undertaking a dynamic energy simulation of the building using the new Performance Pathway for the NCC J1V5 and the addition of 70 kW of solar photo-voltaic (PV) panels on the roof. Refer Appendix A for details.

23 **Energy Source** — **Exceptional Performance 6/6**

100% of the building's energy will come from renewable sources, either on-site, or off-site through strategies such as Power Purchase Agreements (PPAs) or Green Power with an embedded network. This means no on-site gas combustion will be featured on the project, even for heating or cooking with all electric systems.

24 **Other Carbon Emissions** — **Credit Achievement 2/4**

The project will seek to minimise impacts from refrigerants where possible and ultimately commits to offsetting emissions from refrigerants that remain.

25 **Water Use** — **Minimum req.**

The building will use at least 10% less potable water compared to a reference building. The design presently features water efficient fixtures and fittings with rainwater harvesting using an 20 kL tank to meet this requirement. Please refer to marked up plans in appendix B. At this stage the project does not include infrastructure for recycled water connection as there are no known plans for this system in this area.

26 **Life Cycle Impacts** — **Credit Achievement 2/2**

The project will undertake a peer-reviewed life cycle assessment and will show a 30% reduction in life cycle impacts when compared to standard practice. Please refer to the preliminary review in Appendix C. It is noted this credit is high risk as subject to the detailed LCA findings and forms part of the large points buffer adopted on the project.

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Places

6/8 Green Star points

Supports the creation of safe, enjoyable, integrated, and comfortable places.

Promotes actions and solutions that improve the physical and mental health of occupants.

27 **Movement and Place** — **Credit Achievement 3/3**

The building's design and location prioritises walking, cycling, and transport options that reduce the need for private fossil fuel powered vehicles. The architectural strategy to meet these requirements has been implemented early in the design including 90 bike parks and 43 carparking spaces. 6 bike parks for visitors are also provided. Additionally, 3 EV chargers will be provided to carparks. Infrastructure for future EV installation provided for all additional car parks subject to fire risk. Please refer to marked up plans in appendix G.

28 **Enjoyable Places** — **Not Targeted**

The project is committed to including communal or public places that offer a memorable, beautiful and vibrant experience for the community. However the extent of space offered at this stage does not meet the Green Star criteria so the credit is not being pursued at this stage.

29 **Contribution to Place** — **Credit Achievement 2/2**

The project will contribute to the liveability of the wider urban context and enhance the public realm. This will be verified as part of the WAM Urban Context Report.

30 **Culture, Heritage, Identity** — **Credit Achievement 1/1**

Elements of the building's design will celebrate and acknowledge the local people and identity, history and commemorate relevant minorities. The design includes the retention of the existing heritage façade to support this claim and the final design outcome will be reached in collaboration and with meaningful engagement with community groups through the design process as it develops.

People

5/9 Green Star points

Encourages solutions that address the social health of the community.

Promotes actions and solutions that improve the physical and mental health of occupants.

31 **Inclusive Construction** — **Credit Achievement 1/1**

The contractor once appointed will provide gender inclusive facilities and PPE and will have policies on site to increase awareness and reduce instances of discrimination and bullying. The head contractor will additionally provide high quality staff support including mental and physical health support. This will be a specified requirement.

32 **Indigenous Inclusion** — **Credit Achievement 2/2**

The building's design and construction will celebrate Aboriginal and Torres Strait Islander people, culture and heritage by incorporating design features using Indigenous design and planning principles. At this stage this is a commitment and will be developed as the design is detailed in consultation with First Nations people.

33 **Procurement and Workforce** — **Not Targeted**

This credit is not targeted at this stage but will continue to be investigated with the project team as the design develops in case the criteria becomes of interest to the project.

34 **Design for Inclusion** — **Credit Achievement 2/3**

The building will be designed to be inclusive to a diverse range of people, acknowledging the different needs of people to ensure they enjoy an equal experience. This will include equal access to the building, diverse wayfinding and introduction of inclusive spaces. This will be documented in detailed design.

Nature

2/14 Green Star points

Encourages active connections between people and nature and rewards creating biodiverse green spaces in cities.

Promotes actions and solutions that improve the physical and mental health of occupants.

35 **Impacts to Nature** — **Minimum req.**

The building's site is not of significant ecological value, light pollution will be minimised and the design and construction conserves existing natural soil, hydrological flows and vegetation elements. As a building on a previously developed and now cleared site, the project will demonstrate a positive impact to biodiversity by providing additional site ecology.

36 **Biodiversity Enhancement** — **Credit Achievement 2/4**

The development provides >700 m^2 of landscaped area including >30 trees which will be considered with the GBCA to meet criteria as equivalent to nesting trees. Landscaping will also meet various species targets and include critically endangered and/or endangered plant species native to the bioregion. Please refer to marked up plans in appendix E.

37 **Nature Connectivity** — **Not targeted**

This credit is not targeted at this stage but will continue to be investigated with the project team as the design develops in case the criteria becomes achievable with subsequent development of the landscaping. At this stage, the landscaping design is fragmented and does not meet the criteria.

38 **Nature Stewardship** — **Not Targeted**

This credit is not targeted at this stage but will continue to be investigated with the project team as the design develops in case the criteria becomes of interest to the project.

39 **Waterway Protection** — **Not targeted**

Not currently targeted by the project, however the project team will continue to assess whether an annual average flow reduction (ML/yr) of 40% compared to pre-development levels and specified pollutants targets could be met as the project develops. TBC approach. This would require Civil Engineer to undertake MUSIC modelling and integrate onsite stormwater detention and treatment system.

Leadership + Sector Specific points

6 Green Star points

Recognises projects that set a strategic direction, build a vision for industry, or enhance the industry's capacity to innovate.

Promotes actions and solutions that improve the physical and mental health of occupants.

40

Market Transformation — Not targeted

The project is pursuing Passivhaus Certification which is considered world leading for building energy performance. The project team are actively working to meet this target; however this is subject to design development, therefore is not targeted as part of the Green Star pathway at this stage.

41

Leadership Challenges — 1 points targeted

The Climate Positive Pathway Leadership challenge has been met through the alignment of the design with the Green Star Climate Positive Pathway credits, gaining an additional point.

Further opportunities for Leadership will be explored as the design is developed with the project team and more Leadership Challenges are published by the Green Building Council of Australia that can be applied to this type of project.

SS

Tenant Energy Source — Exceptional Performance 5/5

The sector specific credit available for residential projects awards 5 points where at least 80% of tenants by GFA use renewable electricity. The embedded network design proposed for 35-45 Lithgow Street will effectively offer 100% renewable energy to all tenants as part of their rental agreement consistent with the Victorian State Government requirements for embedded networks. We anticipate this will enable all 5 points to be awarded.

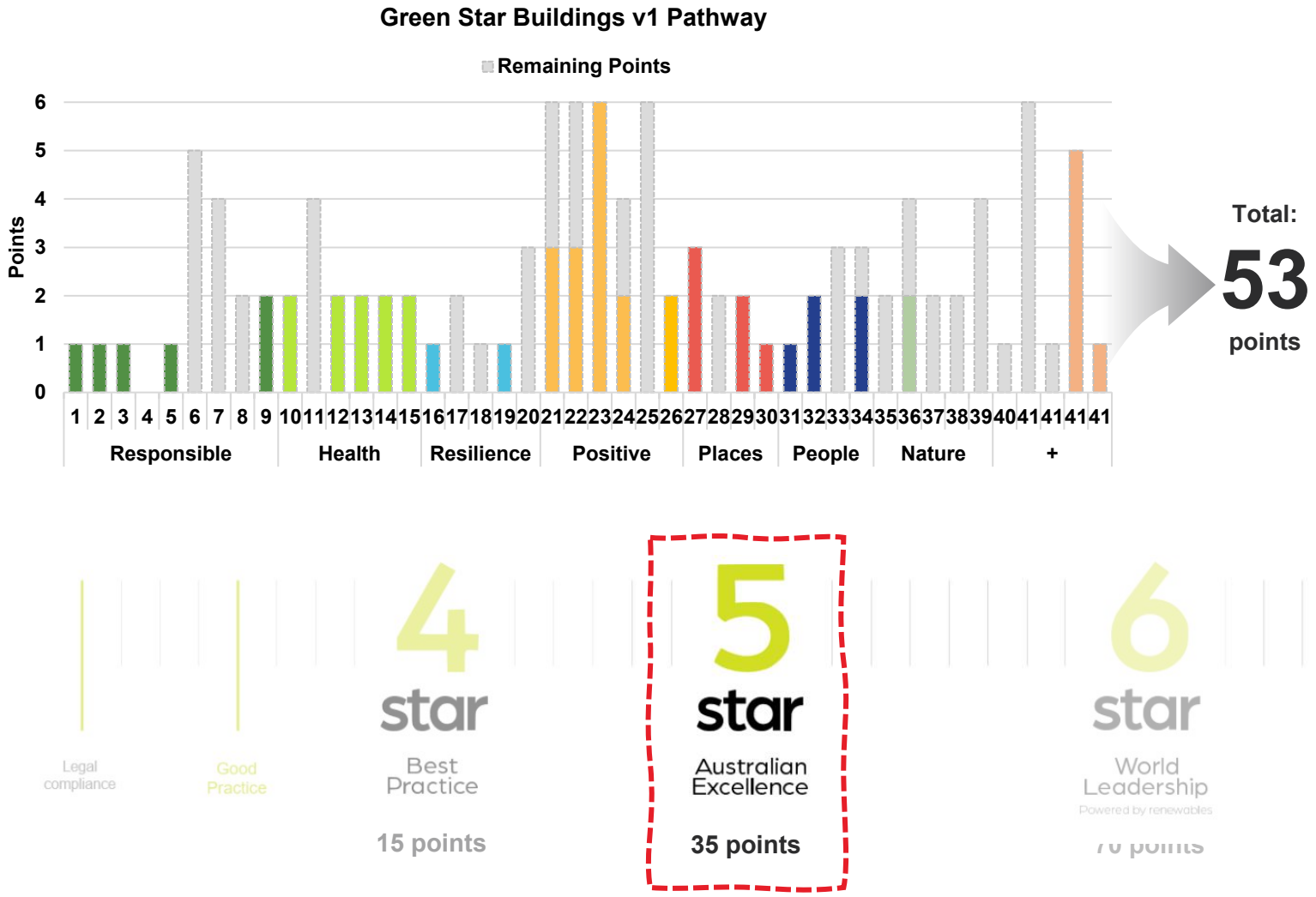
Pathway

5 star Green Star target

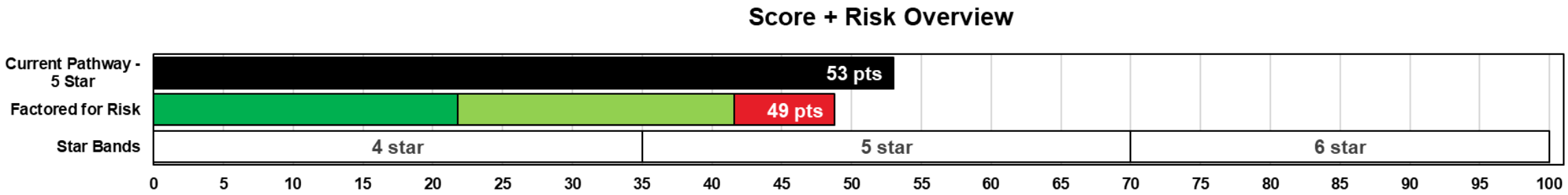
The 35-45 Lithgow St development is targeting >35 points, sufficient to achieve a 5 star Green Star rating using the current version of the national Green Star rating tool. This includes an allowance for points to be lost during the detailed design and construction process whilst also positioning the project to potentially reach 6 star as a stretch target.

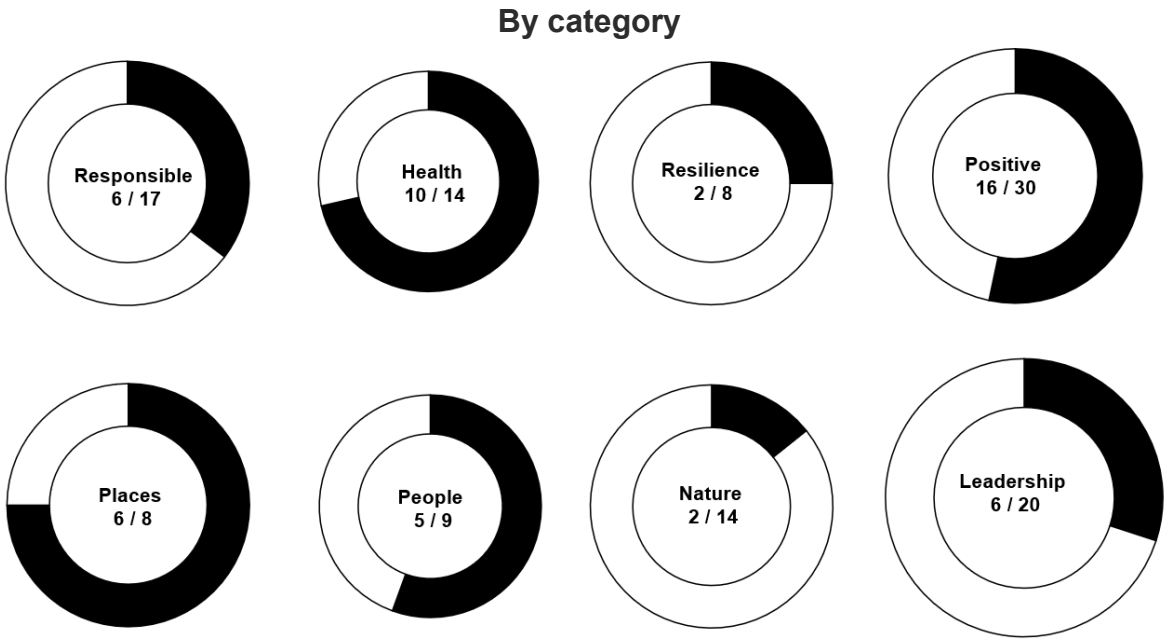
For the full Green Star scorecard, please refer to the appendix.

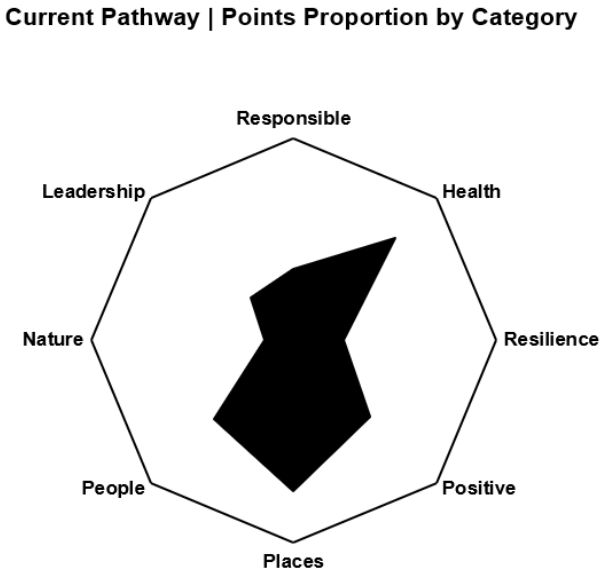
A risk assessment demonstrating the total number of points targeted is sufficient for 5 star at this stage is included on the next page in addition to how the points are achieved for each category. At this stage, the project is on track to achieving at least a 5 star Green Star certified rating.



Risk Assessment and Category Outcomes







Scorecard

Including risks per credit, responsibilities and timing

The scorecard inset reveals the full pathway and the remaining credits within Green Star that will continue to be considered as the project develops in detail.

35-45 Lithgow Street Build to Rent | The Model

ME = Minimum Expectations L = Low M = Medium H = High P = Primary A = Assistance X = Critical C = Consideration

Current Pathway - 5 Star

	#	Credit	Min. Req.	Pathway	Pts	Risk	Project Team: Client	Architect	Façade	Mech	Elec	Hyde.	Structure	Landscape	Civil	ESD	Waste	Acoustics	QS	RBS	ICA	Builder	Timing: Strategy	Brief	Concept	Design	Tender	Build	Handover	Use	Queries	Actions / Notes
Responsible	01	Industry Development		Credit	1	L	P	A	-	-	-	-	-	-	A	-	-	A	-	-	A		C	C	C	X	C	C	C	X		Appoint a GSAP by SD, disclose the costs + market the outcome.
	02	Responsible Construction	ME	Credit	1	M	A	-	-	-	-	-	-	-	A	-	-	-	-	-	P		-	-	-	-	X	C	C	-		EMP, EMS, 90% landfill waste diversion, site staff training and audits
	03	Verification + Handover	ME	Credit	1	L	P	-	-	P	A	A	-	-	-	P	-	-	-	-	P	P	-	C	C	X	X	C	C	C		Envelope air tightness review process that begins in SD
	04	Operational Waste	ME	Minimum	0	L	A	P	-	-	-	-	-	-	-	A	P	-	-	-	-	A	-	-	-	X	-	-	C	C		Allow for suitably seperated waste storage with access
	05	Responsible Procurement		Credit	1	M	P	A	A	A	A	A	A	A	A	A	-	A	-	-	-	A	C	C	C	X	X	C	-	-		ISO 20400 Sustainable Procurement guidelines to be followed.
	06	Responsible Structure		-	0	M	A	-	-	-	-	-	P	-	-	A	-	-	A	-	-	P	-	-	-	-	C	X	C	-		The structure must be specified with recognised accredited products.
	07	Responsible Envelope		-	0	H	A	A	P	-	-	-	-	-	-	A	-	-	A	-	-	P	-	-	-	-	C	X	C	-	-	1	The envelope must be specified with recognised accredited products.
	08	Responsible Systems		-	0	H	A	-	-	P	P	P	-	-	-	A	-	-	A	-	-	P	-	-	-	-	C	X	C	-	-	1	The systems must be specified with recognised accredited products.
	09	Responsible Finishes		Exceptional	2	H	A	P	-	-	-	-	-	-	-	A	-	A	A	-	-	P	-	-	-	-	C	X	C	-	-		The finishes must be specified with recognised accredited products.
Health	10	Clean Air	ME	Credit	2	M	A	A	-	P	A	A	-	-	-	A	-	A	-	-	-	P	-	-	-	X	C	C	-	-		Minimising pollutants, maximising fresh air and enabling maintenance.
	11	Light Quality	ME	Minimum	0	M	A	P	A	-	P	-	-	-	-	A	-	-	-	-	-	A	-	-	X	X	C	-	-	-		Best practice daylight and light to be provided.
	12	Acoustic Comfort	ME	Credit	2	M	A	A	A	P	-	-	A	-	-	A	-	P	-	-	-	A	-	-	-	X	C	C	C	-		Acoustic strategy and best practice management.
	13	Exposure to Toxins	ME	Credit	2	M	A	P	-	-	-	-	A	-	-	P	-	-	-	-	-	P	-	-	-	X	X	C	-	-		Low/zero VOCs and Formaledhydes with on-site testing.
	14	Amenity and Comfort		Credit	2	M	A	P	-	-	A	-	-	-	-	A	-	A	-	-	-	-	-	C	C	X	C	-	C	C		Amenity rooms on-site for parents, relaxation and exercise.
	15	Connection to Nature		Exceptional	2	L	A	P	-	-	-	-	-	P	-	A	-	-	-	-	-	-	-	C	X	X	C	-	C	C		Views, plants, nature-inspired design and integrated nature.
Resilience	16	Climate Change Resilience	ME	Credit	1	L	P	A	A	A	A	A	A	A	A	P	-	-	-	-	-	A	C	C	X	X	C	-	-	-		Climate change risk mitigation strategy adopted.
	17	Operations Resilience		-	0	M	A	-	-	A	A	-	-	-	-	P	-	-	-	-	-	A	C	C	C	X	C	-	C	C		
	18	Community Resilience		-	0	M	A	A	-	-	-	-	-	A	-	P	A	-	-	-	-	A	C	C	C	X	-	-	-	-		
	19	Heat Resilience		Credit	1	M	-	P	-	-	-	-	-	A	-	A	-	-	-	-	-	A	-	-	-	X	C	C	-	-		At least 75% of the area mitigates the urban heat island.
	20	Grid Resilience		-	0	M	-	A	A	-	P	-	-	-	-	P	-	-	-	-	A	A	C	C	C	X	C	-	C	C		
Positive	21	Upfront Carbon Emissions	NZ	Credit	3	M	P	A	A	A	A	A	P	A	P	P	-	A	A	-	-	P	-	C	C	X	X	C	-	-		Upfront greenhouse gas emissions are reduced compared to BAU.
	22	Energy Use	NZ	Credit	3	M	A	A	A	A	A	A	-	-	-	P	-	-	-	A	A	A	-	-	C	X	C	C	C	-		Energy consumption is reduced compared to BAU.
	23	Energy Source	NZ	Exceptional	6	L	P	A	-	P	A	-	-	-	-	P	-	-	-	-	-	A	-	C	C	X	-	-	X	C		Zero Carbon Action Plan plus 100% renewable energy procurement.
	24	Other Carbon Emissions	NZ	Credit	2	M	P	-	-	A	-	-	A	-	-	A	-	-	-	-	-	A	-	-	C	X	C	-	X	C		All upfront emissions are offset to meet 6 star pathway.
	25	Water Use	ME	Minimum	0	M	A	A	-	A	-	A	A	A	P	-	-	-	-	A	A		-	-	C	X	C	C	C	C		The building uses less water than BAU.
	26	Life cycle Impacts		Credit	2	H	A	A	A	A	A	A	A	A	A	P	-	-	-	-	-	A	-	C	C	X	C	C	-	-		The building reduces life cycle impacts compared to BAU.
Places	27	Movement and Place	ME	Credit	3	L	P	P	-	-	P	-	-	-	-	A	-	-	-	A	-	A	X	C	X	X	C	-	-	-		The building includes showers, EOT, EV etc. informed by a plan.
	28	Enjoyable Places		-	0	H	-	A	-	-	P	-	-	-	-	A	-	-	-	-	A	A	-	C	C	X	-	-	-	C		
	29	Contribution to Place		Credit	2	L	P	P	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	C	C	X	-	-	-	C		The building contributes to the wider urban context.
	30	Culture, Heritage, Identity		Credit	1	M	P	P	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-	C	C	X	-	-	C	C		The building's design reflects and celebrates locals and the history.
People	31	Inclusive Construction	ME	Credit	1	L	A	-	-	-	-	-	-	-	-	A	-	-	-	-	-	P	C	C	-	-	X	C	-	-		The building's construction practices are inclusive.
	32	Indigenous Inclusion		Credit	2	L	P	A	-	-	-	-	-	-	-	A	-	-	-	-	-	-	C	C	C	X	C	C	C	C		Indigenous Design Charter is incorporated and followed.
	33	Procurement and Workforce		-	0	L	P	-	-	-	-	-	-	-	-	A	-	-	-	-	-	P	-	-	-	-	X	C	-	-		
	34	Design for Inclusion		Credit	2	M	P	P	A	A	A	A	A	A	A	A	A	A	-	-	-	A	-	C	X	C	C	C	C	C		The building is designed and constructed to be inclusive to a diverse range of people.
Nature	35	Impacts to Nature	ME	Minimum	0	M	P	A	-	-	P	-	-	P	A	A	-	-	-	-	-	P	X	X	C	X	C	X	C	C		Arup to review site's ecological context and workshop with design team
	36	Biodiversity Enhancement		Credit	2	L	A	A	A	-	-	A	A	P	A	A	-	-	-	-	-	A	-	-	X	X	X	C	X	C		The building's site includes a sizeable and diverse landscape area
	37	Nature Connectivity		-	0	L	A	A	-	-	-	-	P	-	A	-	-	-	-	-	-	A	C	C	C	X	C	C	-	-		Species connectivity is encouraged through the site.
	38	Nature Stewardship		-	0	L	P	A	-	-	-	-	P	-	A	-	-	-	-	-	-	-	C	C	X	C	C	-	-	-		
	39	Waterway Protection		-	0	H	A	-	-	-	-	-	-	P	A	-	-	-	-	-	-	A	-	-	C	X	C	C	-	-		Stormwater discharge to be reduced and pollution targets to be met.
+	40	Market Transformation		-	0	H	A	A	A	A	A	A	A	A	P	A	A	A	A	A	A	A	C	C	C	X	C	C	C	C		The project targets Passivhaus and undergoes review process
	41	Leadership Challenges		-	0	H	A	P	P	P	P	P	P	-	-	A	-	-	-	-	-	P	C	C	C	C	X	C	C	C		
		Sector Specific | Collaborative Leasing		-	0	H	P	-	-	A	A	-	-	-	P	-	-	A	A	-	-		C	C	C	C	C	C	X	X		
		Sector Specific | Tenant Energy Source		-	5	H	P	-	-	A	A	-	-	-	P	-	-	A	A	-	-	A	C	C	C	C	C	C	X	X		At least 80% of tenant space (by NLA) uses 100% renewable energy
		Climate Positive Pathway		Pass	1	L	P	A	A	P	A	A	P	A	P	P	-	A	A	-	-	A	C	C	C	X	C	C	C	C		15 points within the Climate Positive Pathway is achieved.

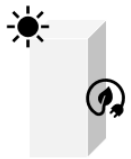
Total points:	53	This is the total number of points including the leadership points. A limit of 100 is applied even if more than 100 are achieved.
Weighted for risk:	48.8	The risk weighting factors being applied are 0.99 for low, 0.9 for medium and 0.8 for high.
Estimated rating:	5 star	The boundaries for each star rating are 0 for 4 star, 35 for 5 star and 70 for 6 star.

Green Star Scorecard

Appendices

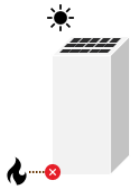
ARUP

Energy Efficiency
Appendix A



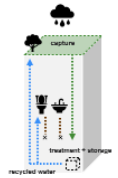
ARUP

Energy Use
Appendix B



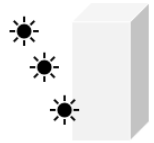
ARUP

Water Use
Appendix C



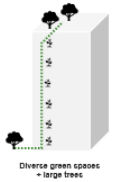
ARUP

Amenity and daylight
Appendix D



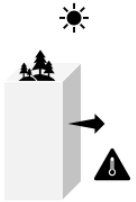
ARUP

Biodiversity and biophilia
Appendix E



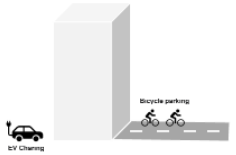
ARUP

Urban Heat Island
Appendix F



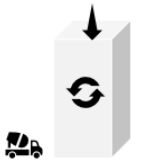
ARUP

Transport
Appendix G



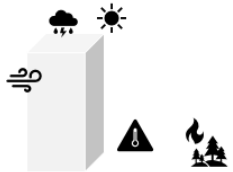
ARUP

Materials + Upfront Carbon
Appendix H



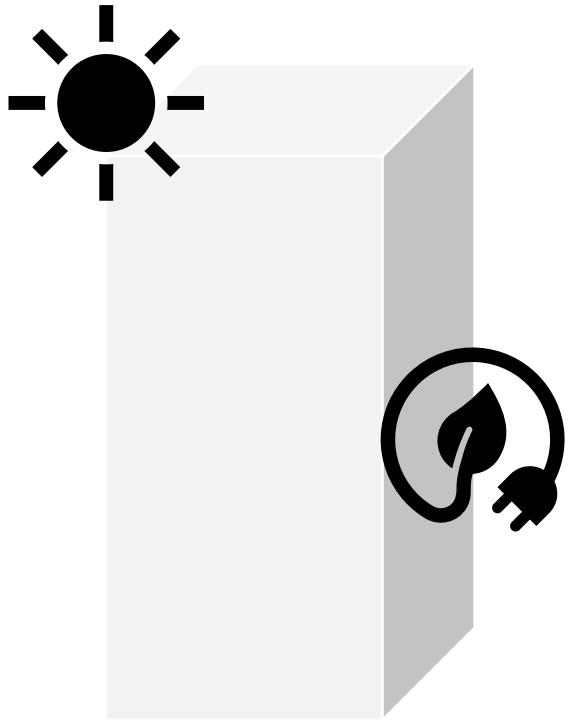
ARUP

Climate Resilience
Appendix J



Energy Efficiency

Appendix A



Energy efficiency

Façade thermal performance overview

The Factory is targeting Green Star Credit 22: Energy Use, pursued under the Climate Positive Pathway. The development is primarily a Class 2 residential project with additional mixed-use functions. Preliminary energy modelling has been undertaken using NatHERS and the Hero software on a mix of thermally representative apartments. Green Star requires that a 7 Star average is achieved, which is in line with the latest NCC 2022 minimum update. A minimum of 6 stars must be achieved per apartment to align with both NCC 2022 and Green Star.

Additionally, the development features a variety of community space, categorised as Building Code of Australia (BCA) Class 2, and Class 6 retail. The required façade thermal performance for these areas has been assessed using NCC Section J DtS, targeting a 20% improvement beyond code compliance to align with Green Star credit achievement.

A summary of facade thermal performance requirements is shown inset, with further modelling details and results outlined on the following pages.

The project is committed to achieving 7 stars, however the performance requirement inset are subject to change pending design development. These are minimum requirements.

Fabric	Performance requirement	Residential areas	Non-residential
Glazing	Total system U-value	≤ 2.5 W/m^2.K *Double glazing with timber or aluminium thermally broken frames*	≤ 4.0 W/m^2.K *Double glazing*
	SHGC	0.30 ±5%	< 0.70
	Window operability	As drawn in architectural documentation	-
	Skylights	-	≤ 3.9 W/m^2.K and SHGC ≤ 0.29 *Double glazing with low-e*
Solid areas	Wall R-Value (m^{2}K/W) *includes thermal bridging effects*	≥ 2.7 m^2.K/W insulation *Steel framing 150mm with thermal breaks*	≥ 1.0 m^2.K/W *Requiring wall insulation upgrades*
	Ceiling R-Value (m^{2}K/W) *includes thermal bridging effects*	≥ 5.0 m^2.K/W insulation	≥ 3.2 m^2.K/W total system R-value *Requiring roof insulation upgrades*
	Exposed floor R-Value (m^{2}K/W) *includes thermal bridging effects*	≥ 2.0 m^2.K/W total system R-value	≥ 2.0 m^2.K/W total system R-value *For any exposed floors*
Shading	Extent	Neighbouring buildings and privacy screens as drawn in architectural documentation. Shading equivalent to ≥600mm horizontal shade to west facing windows. Currently assumed as awnings, with details to be resolved in design development.	As drawn in architectural documentation.
Air-tightness	Limit verified with test	< 5 m^3/hr/m^2 (good practice for residential) with 10% of dwellings tested FAQ 397.	*Requirement to be confirmed with the GBCA for existing building.*

Residential areas

Modelled apartments

A mix of apartments covering a representative range of layouts and thermal conditions have been modelled at this stage, including:

- Unit S-01 which is representative of ~20% of units
- Unit 1B-01 which is representative of ~30% units.
- Unit 1B-09 which is representative of ~10% of units.
- Unit 2B-04 which is representative of ~5% of units
- Top floor exposed units that are considered to have the most challenging thermal conditions due to high exposure of the roof and south and west-facing facade.

We have modelled the ground floor and top floor units across multiple aspects, ensuring typical and most thermally challenging conditions are represented.

APARTMENT TYPE	NO. OF TYPE IN BUILDING
S-01	28
S-02	9
S-03	2
S-04	3
S-05	1
S-06	5
S-07	1
S-08	1
S-09	3
S-10	1
1BS-01	3
1BS-02	5
1BS-03	1
1B-01	44
1B-02	4
1B-03	1
1B-04	2
1B-05	1
1B-06	1
1B-08	1
1B-09	15
2B-01	3
2B-02	3
2B-04	6
2B-05	1
2B-06	1
2B-07	1
2B-08	1
2B-09	1
2B-10	1
2B-11	1

APARTMENT TYPES	APARTMENT COUNT
31	151

Summary of modelled apartments within the development

- Unit 1B-01 (~30% units)
- Unit 1B-09 (~10% units)
- Unit S-01 (~20% units)
- Unit 2B-04 (~4% units)
- Unit 2B-09, 2B-11, 2B-10, 1B-08 (top floor exposed units)

Ground Level

Level 05

Residential areas

Heating and cooling load results

The heating and cooling load results for each of the selected apartments is shown inset. These results represent predominantly edge-condition units covering a range of exposure conditions and orientations.

The total thermal load for all apartments is below the limit of 62 MJ/m^2 for 7 stars. A 7.9 star average across the tested apartments has been calculated, with 7.0 stars the minimum rating achieved by the worst-case unit. The results show that the maximum cooling load across the development is 33.6 MJ/m^2, which is within the ADGV cooling load limit of 41 MJ/m^2.

These results show that there is an appropriate buffer to allow for changes during design development. Given the modelled units represent the most thermally challenging edge conditions, we anticipate that the remaining apartments will perform higher.

Apartment name	Heating Load (MJ/m^2)	Cooling Load (MJ/m^2)	Total thermal load (MJ/m^2)	Meets cooling load limit	Estimated star equivalency
0_1B-01_1	28.2	19.7	48	✓	7.8
0_1B-01_2	32.6	6.5	39	✓	8.2
0_1B-09_1	23.6	30	53.6	✓	7.4
0_1B-09_2	43.5	8.9	52.4	✓	7.4
0_S-01_1	14.5	12.7	27.2	✓	8.9
0_S-01_2	25.2	13.5	38.6	✓	8.3
5_1B-01_1	9.9	13.2	23.1	✓	9.1
5_1B-01_2	12.7	21.9	34.6	✓	8.4
5_1B-08_1	21	31.8	52.7	✓	7.4
5_1B-09_1	20	28	48	✓	7.8
5_2B-04_1	16.9	24.7	41.6	✓	8.1
5_2B-04_2	31.6	14.6	46.2	✓	7.9
5_2B-09_1	19.2	26.8	45.9	✓	7.9
5_2B-10_1	28.3	33.6	62	✓	7.0
5_2B-11_1	39.3	16.7	56	✓	7.3

Heating and cooling results for tested apartments

Non-residential areas

J4D6 Walls and glazing

The Method 2 DTS pathway in NCC 2022 sets targets for the total façade performance with regards to thermal and solar requirements.

It effectively requires the following criteria to be met:

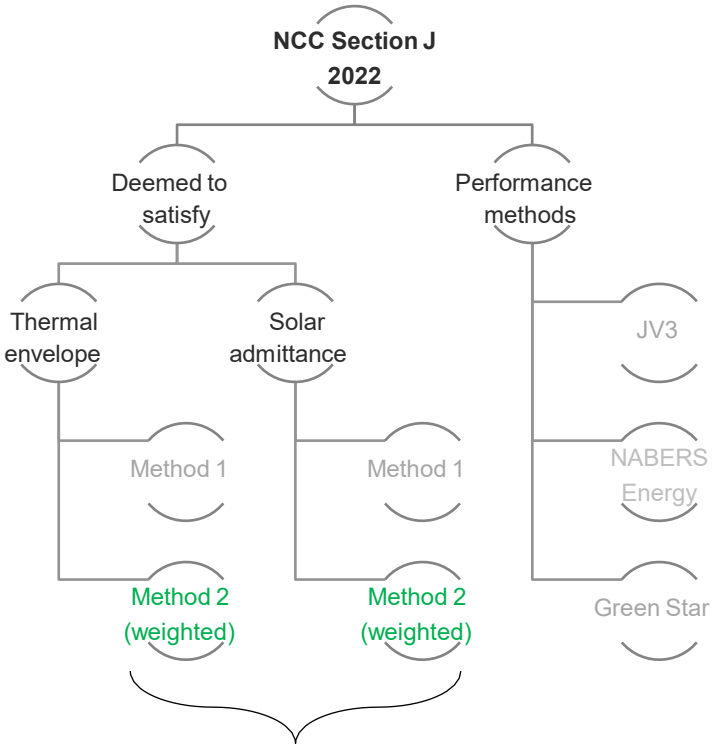
- Total system U-value of 2.0 W/m².K for combined window and wall performance.
- Overall solar effectiveness of 0.13 for combined window and wall performance, with adjustments made for orientation.

Method 1 would require all facades to meet this criteria which would be very onerous but Method 2 enables all facades to be considered in a combined calculation so trade offs can be calculated.

This effectively enables some areas of the building's performance to offset others.

National Construction Code

NCC Section J for 2022 with combined window and wall requirements



Method 2 proposed as enables flexibility across thermal and solar envelopes where facades can offset others.

National Construction Code — Volume One Building Code of Australia

J4D6 Walls and glazing

(1) The *Total System U-Value* of *wall-glazing construction*, including *wall-glazing construction* which wholly or partly forms the *envelope* internally, must not be greater than—
  (a) for a Class 2 common area, a Class 5, 6, 7, 8 or 9b building or a Class 9a building other than a *ward area*, U2.0; and
  (b) for a Class 3 or 9c building or a Class 9a *ward area*—
    (i) in *climate zones* 1, 3, 4, 6 or 7, U1.1; or
    (ii) in *climate zones* 2 or 5, U2.0; or
    (iii) in *climate zone* 8, U0.9.

(2) The *Total System U-Value* of *display glazing* must not be greater than U5.8.

(3) The *Total System U-Value* of *wall-glazing construction* must be calculated in accordance with Specification 37.

(4) Wall components of a *wall-glazing construction* must achieve a minimum *Total R-Value* of—
  (a) where the wall is less than 80% of the area of the *wall-glazing construction*, R1.0; or

Table J4D6a: Minimum wall Total R-Value - Wall area 80% or more of wall-glazing construction area

Climate zone	Class 2 common area, Class 5, 6, 7, 8 or 9b building or a Class 9a building other than a *ward area*	Class 3 or 9c building or Class 9a *ward area*
1	2.4	3.3
2	1.4	1.4
3	1.4	3.3
4	1.4	2.8
5	1.4	1.4
6	1.4	2.8
7	1.4	2.8
8	1.4	3.8

Table J4D6b: Maximum wall-glazing construction solar admittance - Class 2 common area, Class 5, 6, 7, 8 or 9b building or Class 9a building other than a ward area

Climate zone	Eastern aspect *solar admittance*	Northern aspect *solar admittance*	Southern aspect *solar admittance*	Western aspect *solar admittance*
1	0.12	0.12	0.12	0.12
2	0.13	0.13	0.13	0.13
3	0.16	0.16	0.16	0.16
4	0.13	0.13	0.13	0.13
5	0.13	0.13	0.13	0.13
6	0.13	0.13	0.13	0.13
7	0.13	0.13	0.13	0.13
8	0.2	0.2	0.42	0.36

Thermal markup

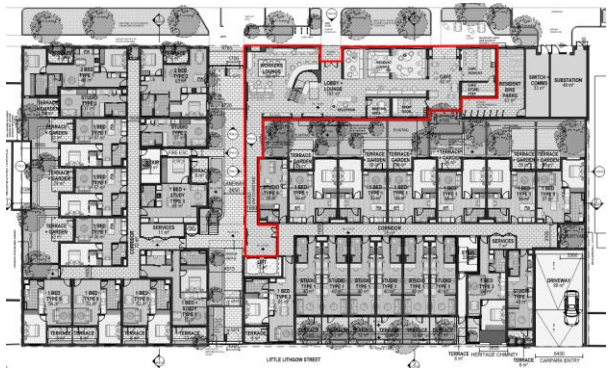
Residential amenities in existing building

The drawings inset highlight the thermal boundary of the residential amenities building. The boundary includes all the following, with the listed assumed NCC Classes:

- Co-working space, workers lounge, and meeting areas assumed for use by residents only and included as Class 2 residential amenities.
- Residents lounge, lobby, gym, stretch zone as well as glazed walkway assumed as Class 2 residential amenities.
- Ground floor café included as Class 6

The envelope areas are summarised below:

Aspect	Wall area	Glazed Area
North	110m^2	105m^2
East	320m^2	70m^2
South	90m^2	35m^2
West	325m^2	45m^2
% of total	**78%**	**22%**

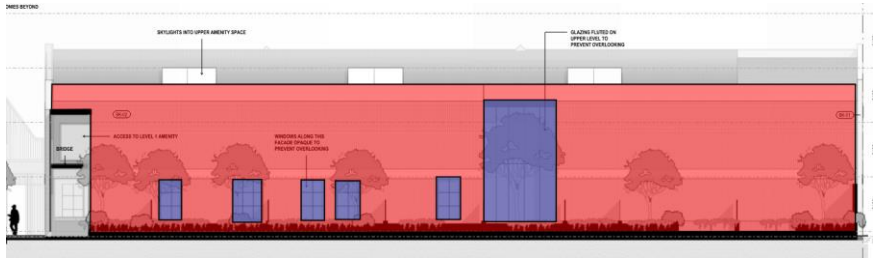


Ground floor

Level 1

Thermal boundary markup residential amenities

East elevation



West elevation

North elevation

South elevation

Non-residential areas

NCC Section J DtS Overview

The communal portion of the development has been reviewed against Section J4D6 of the National Construction Code (NCC). The project is situated in NCC Climate Zone 6.

This building is an existing brick building, therefore will require upgrades to the internal lining to meet the minimum performance requirements.

Section J4 Building fabric of the NCC assesses the thermal and solar performance of building façades using an area weighted calculation with performance values against allowable limits. All residential common areas must have a thermal performance below 2.0 m^2K/W and solar performance with an air-conditioning energy value (Er) below the limit calculated for building. This calculation uses Method 2 of Specification 37 which allows thermal performance to be balanced across multiple aspects.

This assessment is targeting an improvement of 20% over NCC minimum requirements for both thermal and solar performance in line with Green Star Credit achievement. However, an outcome below this is allowable as further energy efficiency improvements can be implemented in other parts of the design, such as efficient HVAC and lighting.

Results

Proposed thermal performance requirements for each common area building façade are summarised in the table to the right.

Due to the relatively low glazing ratio on this building (~22%), a 20% improvement over NCC is achievable with clear double glazing and internal wall lining upgrades of R1.0 $m^2.K/W$.

In addition to the performance requirements highlighted inset, the following will also be met to comply with NCC Section J:

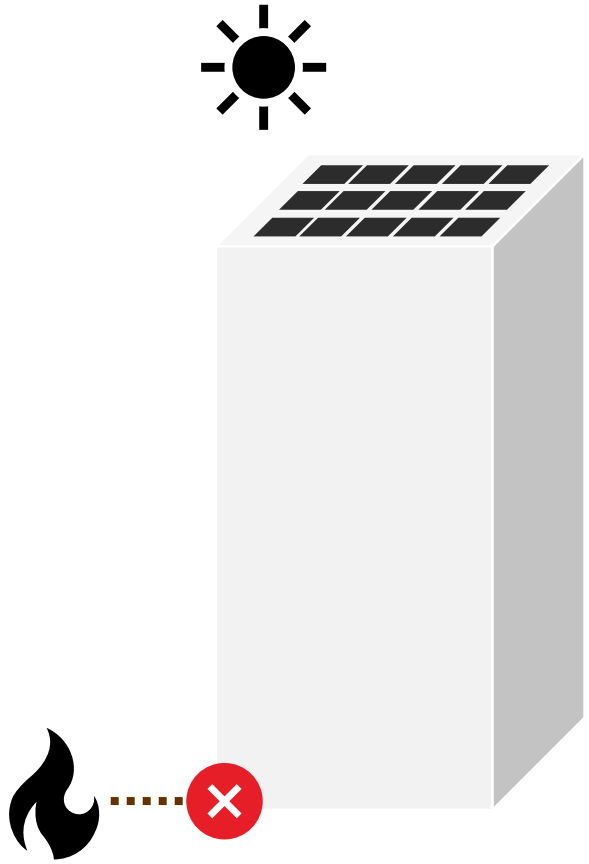
- **Skylights** will have an SHGC ≤ 0.29 and a total system U-value of ≤ 3.9 W/m^2K
- **Roof** will be upgraded to achieve a total system R-value of ≥R3.2 m^2K/W.
- **Exposed floors** will achieve a total system R-value of ≥ R2.0 m^2K/W

Fabric element	Thermal performance requirements
Window U-value	≤ 4.0 W/m^2K
Window SHGC	0.70 ±5%
Wall R-value	≥ 1.0 m^2K/W

Results	Thermal performance requirements
Wall-glazing U-value	1.53 (23% improvement over NCC)
Energy value (E_R)	177 (29% improvement over NCC)

Energy Use

Appendix B



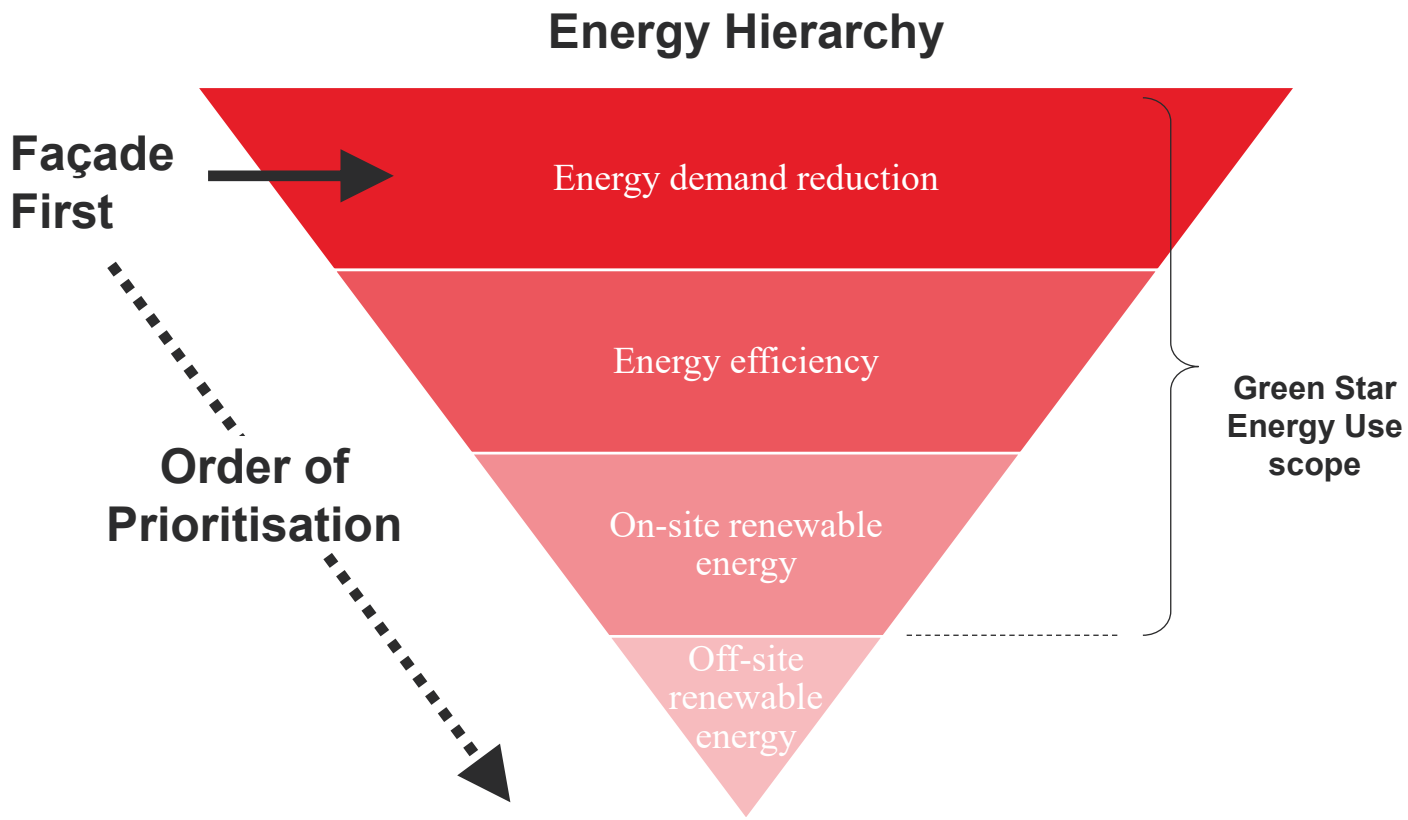
Exceeding Section J Compliance

Fabric First Approach

The façade is the first opportunity for the building to achieve the targeted 20% reduction in energy use overall.

Preliminary design targets to meet brief (for residential areas):

- Window to wall ratio as per design documentation (~30-40%) overall to efficiently manage solar heat gains, while balancing daylight amenity
- Window total system U-value of 2.5 W/m^2.K, requiring timber or aluminium thermally broken double glazed windows.
- SHGC 0.30 ±5% (with VLT >40%) with 200-600mm deep shading devices applied to critical areas on the western aspect, and top floor apartments with high exposure.
- R2.7 m^2.K/W wall insulation (e.g. 90mm rockwool)
- R5.0 m^2.K/W insulation for roofs and R2.0 m^2.K/W floor insulation for exposed floors, including floors above carpark.
- 5m^3/hr/m^2 air tightness for apartments, evidenced by a test.
- Thermal bridges addressed at junctions, such as balconies.



High Performance All Electric Design

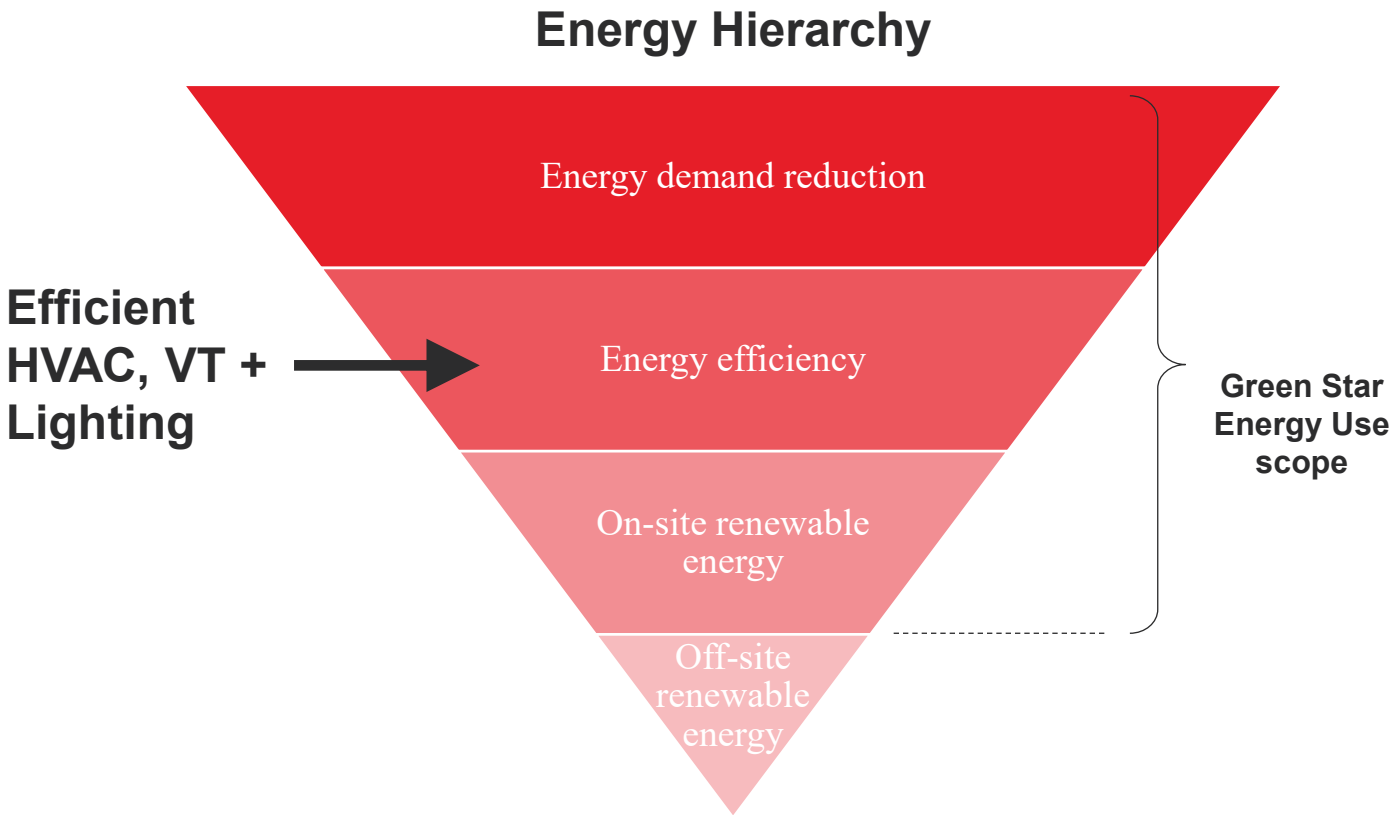
Energy Efficient

The HVAC, vertical transport and lighting systems must be efficient, exceeding the NCC. For compliance with Green Star credit 22 Energy Use, at least four best practice building services requirements must be achieved.

The project intents to target the following to achieve this, however all are subject to further design development:

- Energy efficient air-conditioning systems with low refrigerant global warming potential (R32).
- Ceiling fans to each bedroom and living room
- Centralised electric heat pumps for domestic hot water with a seasonal coefficient of performance of at least 3.
- 70 kW solar PV array across the rooftops, aligned with best practice Green Star requirements to provide 500 kWh of annual electricity per dwelling.
- Lighting with 30% reduction in aggregate using controls, sensors and LED fittings.
- Corridors are provided with supply and exhaust air only with no heating or cooling.

This is aligned to the Green Star good practice measures required for Credit Achievement.



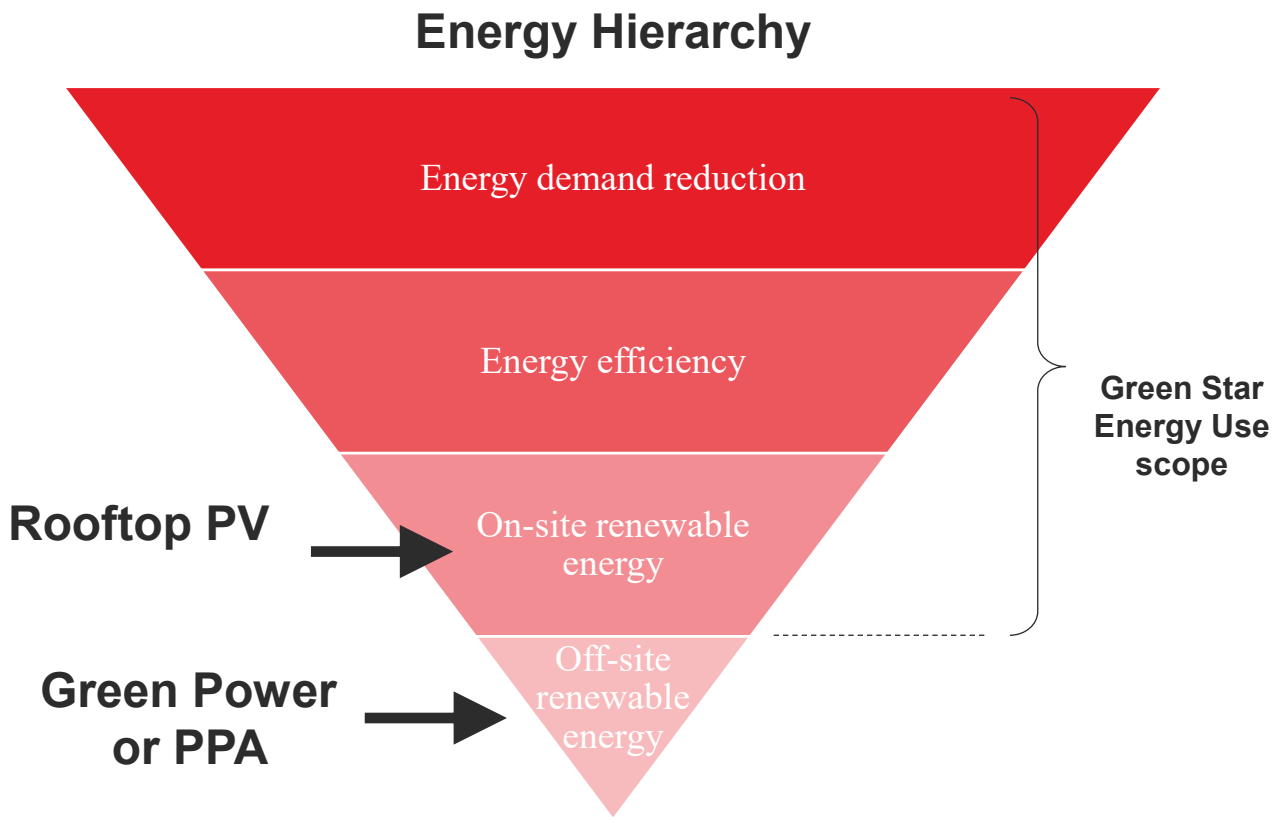
Generating Renewable Energy

100% Renewable in Operation

The building will adopt renewable energy on-site and off-site.

Design targets are:

- 70 kW of PV on the roof (or sufficient to meet Green Star best practice requirements)
- Off-site renewable energy will be procured for the whole development as an embedded network offered to all residents.



Rooftop Solar

Marked up plans

The town planning documentation developed by Warren and Mahoney and the project team shows that a 70kW solar PV array will be installed across ~210m^2 of available roof area.

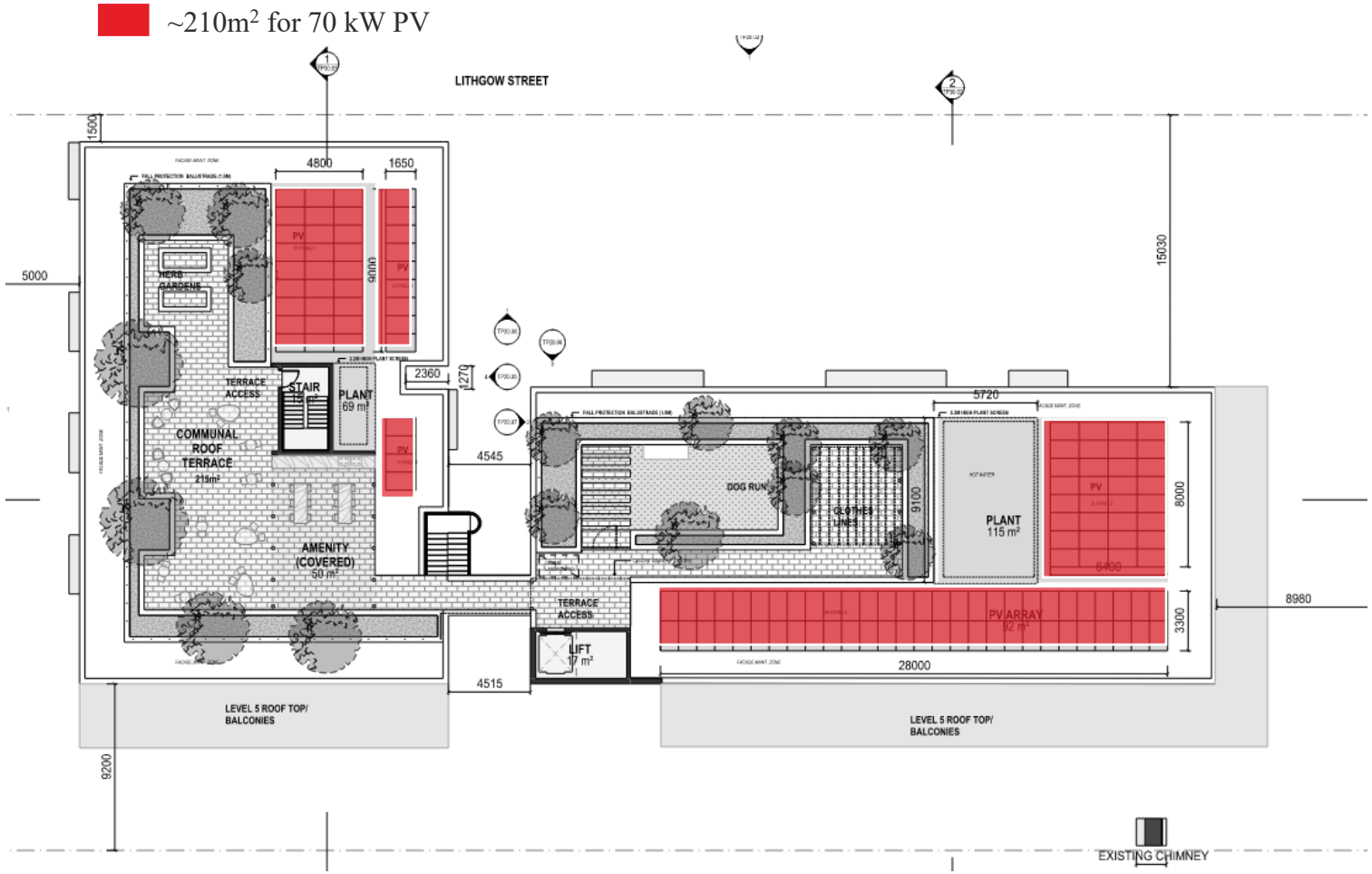
The Victorian Government embedded energy conditions mandate minimum 5% of residential energy use to be met with on-site renewable energy generation.

The proposed solar PV array will be connected to the building and contribute to the reduction in energy use and is estimated to contribute to ~15% of the residential annual energy demand, exceeding Victorian Government requirements and aligning with Green Star best practice.

The latest PV panel technology commercially available will be implemented at the time of tender with high performance PV panels currently assumed.

The building is all electric and will source 100% renewable energy for all residential common area energy uses.

The proposed locations of solar PV panels on each building is shown in the figure inset and will be further developed in design development including impacts of overshadowing considered.



Roof plan showing proposed solar PV array

Whole of Home Energy

Demonstrating compliance with NCC

Under NCC 2022, all new Class 2 apartments must comply with updated Whole-of-Home (WoH) energy performance requirements. Each dwelling must achieve at least 50 WoH points, based on the building fabric performance, efficiency of fixed appliances (heating, cooling, and hot water), lighting, and provision of on-site renewable energy generation.

The proposed strategy includes:

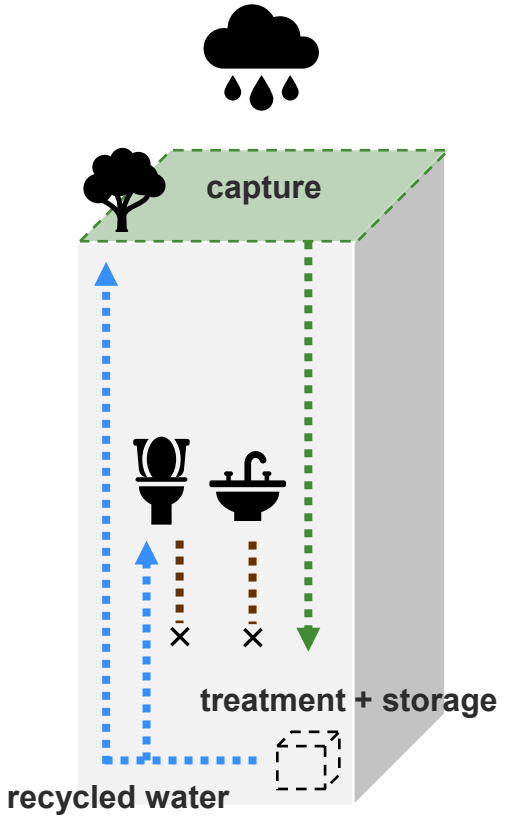
- Central heat pump hot water systems meet WoH criteria
- PV system sizing and locations will be refined during Design Development

The project is committed to achieving WoH compliance and the preliminary desktop assessment has confirmed a suitable pathway to achieving this. Key assumptions are outlined in the adjacent table and will be reviewed and confirmed during detailed design.

Criteria	Residential strategy
Apartment heating and cooling demand	7 star average or equivalent minimum
Heating and cooling system efficiency	EER/COP of 3.5 or equivalent
Hot water system	Centralised hot water heat pumps
Lighting	20% better than NCC (~3.2 W/m² average)
Solar PV	~500 kWh/yr per apartment
Compliance with WoH	✓

Water Use

Appendix C



Criteria

Green Star Water Use Credit

The aim of credit 25 Water Use is to ensure that the building has low water use. There are three criteria for this credit for residential projects, which are shown inset:

Minimum Expectation

- **10%** reduction in potable water compared to a reference building

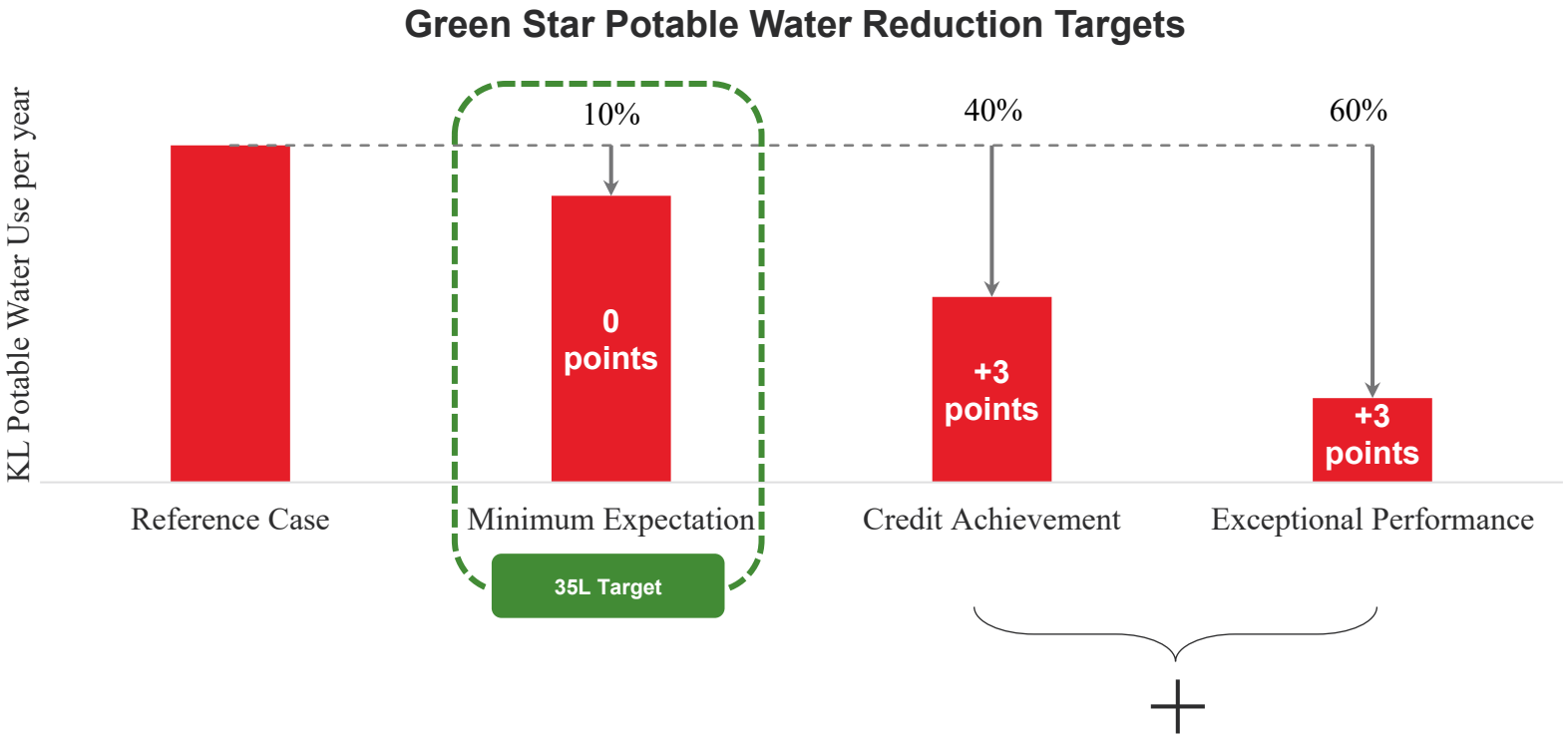
Credit Achievement (3 points)

- **40%** reduction in potable water compared to a reference building
- Recycled water infrastructure – see inset for details

Exceptional Performance (+3 points)

- **60%** reduction in potable water compared to a reference building

The current design is targeting minimum expectation (10% reduction) for this credit. This is due to the limited availability of rainwater compared to the demand for the site, and low feasibility of greywater treatment.



Recycled Water Infrastructure

The building must have infrastructure for recycled water in a district or location where local council or water authorities have planned for installation of recycled water infrastructure

Assumptions

Calculations

At this stage the calculations are preliminary and are based on a series of assumptions to inform the analysis and determine a suitable combination of water efficiency and water reuse to meet the target.

The building type is defined as residential, and these assumptions are expected to be refined as the design develops.

This assessment has been undertaken with the Green Star Design and As-built Potable Water calculator with the understanding that this same method will be adopted for the Green Star Buildings rating. At this stage, there is no Green Star Buildings Water calculator that is available from the Green Building Council of Australia.

We have assumed that washing machines and dishwashers are provided to tenants.

The following assumptions are preliminary and high level and will be refined as the design progresses:

- Washdown water use for cleaning paved areas.
- Water used for fire system testing is a high-level assumption at this stage and will be confirmed with the fire engineer as the project progresses.
- We have assumed ~50 occupants use the showers within the exercise and spa facility per day.

Occupancy

Residents	221
Apartment Net Area	9,379 m^2
Amenity Area	3,000 m^2

Washdown

Hose flowrate	20 L/min
Number of hoses	2
Average daily use	30 mins

Landscape Irrigation

Landscaped area	~ 700 m^2
% of zone undercover	0%
Crop coefficient	0.5 (low water req.)
Irrigation	Subsurface drip irrigation (90% efficiency)

Fire systems

% of water captured per test	80%
Testing frequency	annually
Volume discharged per test	1,000 L

Fixtures + fittings (WELS ratings)

Taps	6 star (<5.5 L/min)
Toilets	4 star (<3.5 L/flush avg)
Showers	3 star (<7.5 L/min)
Washing Machines	4 star (<10 L/kg)
Dishwashers	6 star (<14 L/cycle)

Rainwater collection

Rainwater collection area (m^2)	1,785 m^2 (new + heritage)
Rainwater tank size	20 kL
Roof	Flat without gravel
End uses connected to	Toilets, irrigation
Point potential evaporation data	Melbourne (BOM)
Connected to	~100% of toilets and irrigation

White goods

Washing machines	1 per apartment installed by Model
Dishwashers	1 per apartment installed by Model

Pools

Hot plunge	~3m^2 × 1m deep
Cold plunge	~4m^2 × 1m deep

Rainwater collection

Roof area and irrigation area

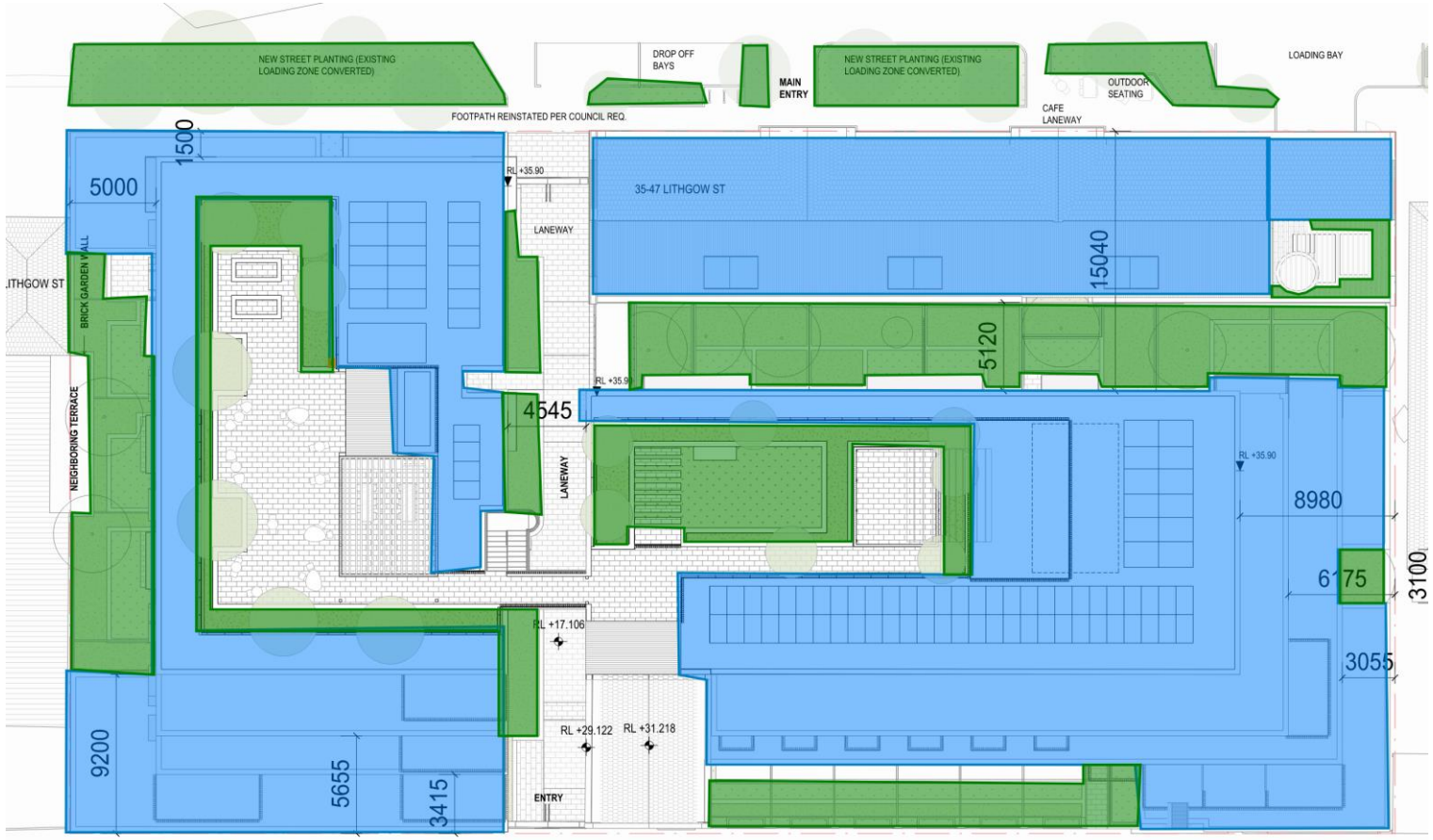
The total roof area for rainwater runoff collection is 1,800m^2.

It excludes areas with pervious surfaces such as the garden beds and the dog's run area as well as trafficable areas.

The total landscaped area assumed to have irrigation requirements is ~700m^2, as shown inset.

Roof area included for rainwater collection ~1,800m^2

Landscaped areas for irrigation ~700m^2



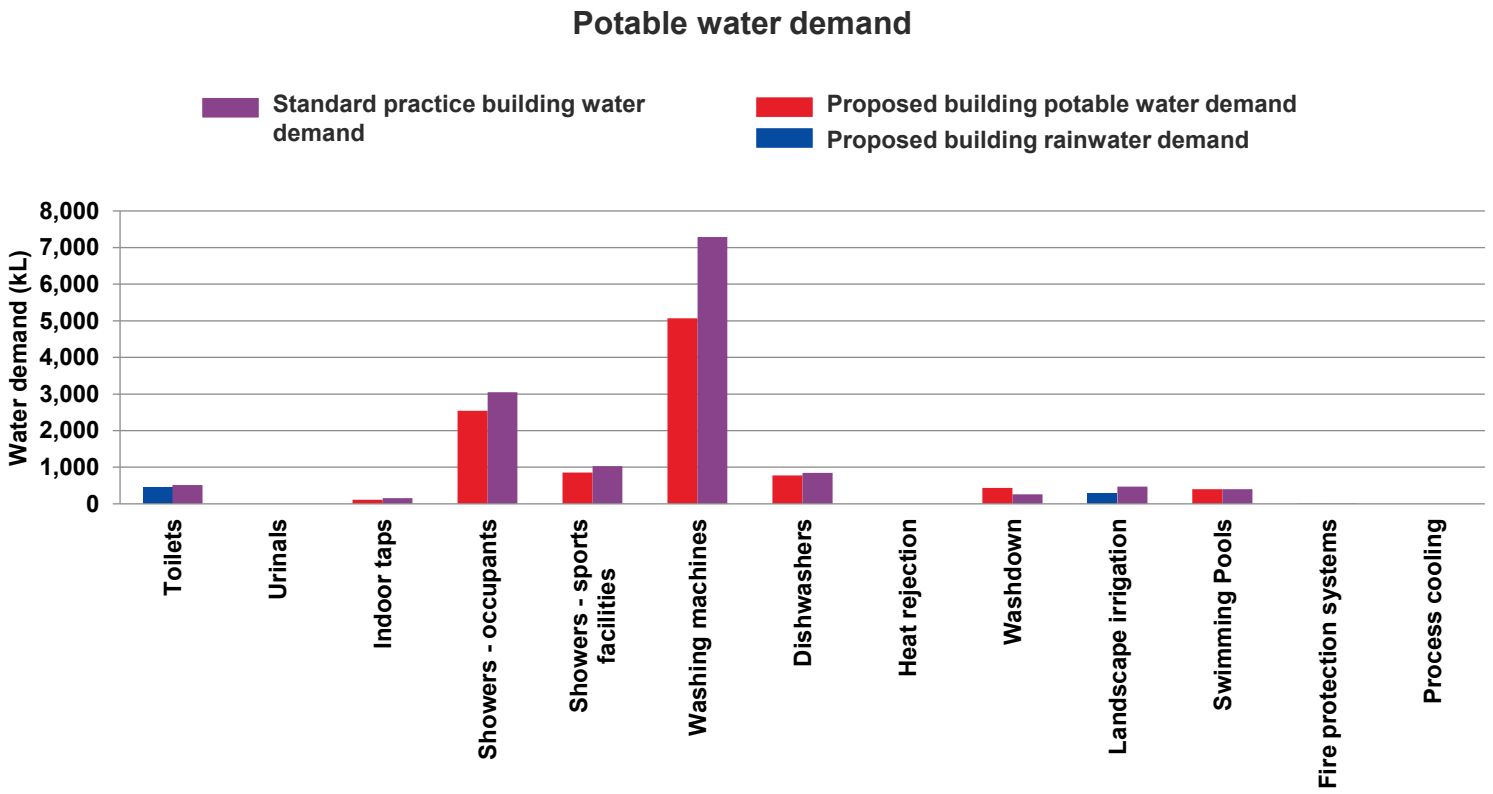
Results

Potable water reduction of 25% achieved

The water consumption for the whole development has been estimated on the basis of the assumptions and operation anticipated for the building, based on estimated occupancy.

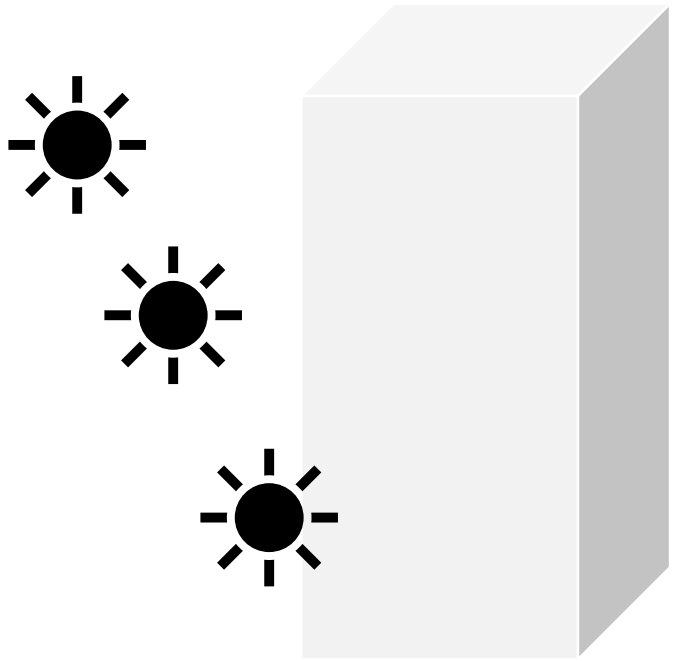
The washing machines represent the largest water demand, followed by showers, dishwashers and toilets.

The rainwater system capacity has been optimised to size a 20 kL tank, achieving a 25% reduction in potable water use compared to business as usual. This exceeds the 10% reduction requirement for achieving Green Star Minimum Expectation.



Amenity and daylight

Appendix D



Amenities markup

~150 m^2 amenities spaces including a resident lounge, stretch room and wellness terrace with a spa and sauna.

These spaces are for the primary purpose of promoting mindfulness, light exercise and inclusivity for residents.

Ground floor = ~45m^2 resident lounge

Level 1 = 126m^2 stretch zone and wellness terrace

Daylight Criteria

Driven by Green Star

The project is located within the Yarra City Council and is therefore required to meet the council's minimum building requirements.

In addition to the Victorian Apartment Design Guidelines requirement of a room depth <9m to allow for adequate daylight, the project must also meet the objectives outlined in the City of Yarra's ESD Policy, which includes an assessment using either BESS or Green Star.

The project is targeting a 5 star Green Star rating, and so this approach will be taken.

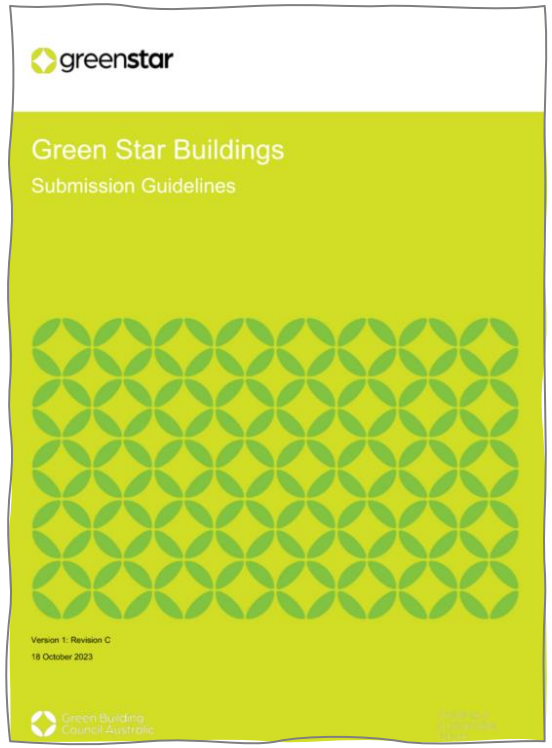
Within Green Star, there are two levels of compliance for daylight;

- **Minimum expectation (mandatory):** 95% of all apartments, the living rooms and all bedrooms have access to a view and daylight. The project cannot be overshadowed, and glazing must have a VLT of >40%.
- **Credit achievement (optional 2 points):** 60% of combined living and bedroom area of each unit and minimum 20% of each separate area must have at least 160 lux daylight during 80% of nominated hours.

The project is targeting the Green Star Minimum Expectation and has undertaken a preliminary daylight review to inform design outcomes.

ADGV

+



Green Star

Daylight | Green Star Minimum Expectation

Green Star Minimum Expectation

The 35-45 Lithgow Street development places the quality of living and indoor environment of high importance for residents. As such, the project has prioritised striking a balance between thermal comfort with daylight and views, with carefully placed and sized windows that maximise daylight whilst reducing glare and undesirable excess summer sun.

The narrative inset details how the project meets and exceeds the minimum expectation criteria for daylight, ensuring that residents not only have access to daylight amenity within their apartments but in communal spaces also.

Minimum expectation criteria	35-45 Lithgow Street project narrative
Maximises the number of occupants that are in or near daylit areas during their daily activities for all building types	All apartments have access to daylight with windows to all living areas and bedrooms, ensuring most occupants spend their daily activities in daylit areas. Studio apartments locate the living space adjacent to the façade, which is where occupants are anticipated to spend most of their daytime hours.
Ensures regularly occupied areas are in reasonable proximity to glazed façades, windows, or skylights	All regularly occupied areas are adjacent to a window, with all living rooms provided with a double sliding glazed door to a balcony, and all bedrooms include an operable window. The bedroom sections of studio apartments are located no more than 5m away from the window.
Controls or mitigates external glare in the daylit spaces	External glare will be mitigated through the provision of blinds and external shading along exposed facades. Additionally, the design seeks to frame views to reduce exposure to direct sunlight.
Maximises daylight to spaces that prioritise learning, healing, and living, including how in 95% of apartments, the living rooms and bedrooms have access to a view and daylight	The project has been designed to promote views towards the landscaped terrace areas, for all apartments. Lower-level units that experience lower levels of daylight have prioritised access to nature views with dappled light. They will also include larger windows and have close access to the project's daylit amenities spaces.
Provides building occupants with unrestricted access to daylit indoor public common spaces	The ground floor and upper-level communal areas (lobbies, lounges, corridors, amenity spaces) are adjacent to large glazed façades and/or open to outdoor terraces. These spaces are accessible to all building occupants and receive direct daylight, as confirmed by the shadow diagrams on the following page.

Preliminary Daylight Review

~92% apartments have access to good levels of daylight as per the Green Star criteria, however the remaining 8% are designed to maximise daylight with larger windows, access to outdoor daylit areas and nearby access to the well-lit amenities building.

This is considered compliant with the Green Star Minimum Expectation criteria, with the barriers being the heritage building and the depth of the site, whilst measures such as larger external terrace areas and balconies as well as shared rooftop amenity areas can help mitigate the loss of daylight quality for these occupants.

Good daylight anticipated Moderate daylight anticipated Lower levels of daylight anticipated

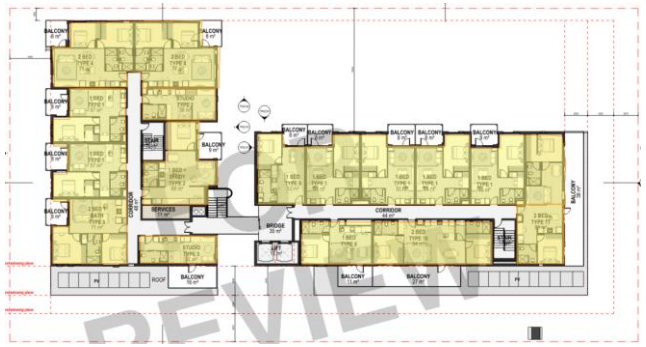
Ground floor

Level 1

Level 2

Level 3

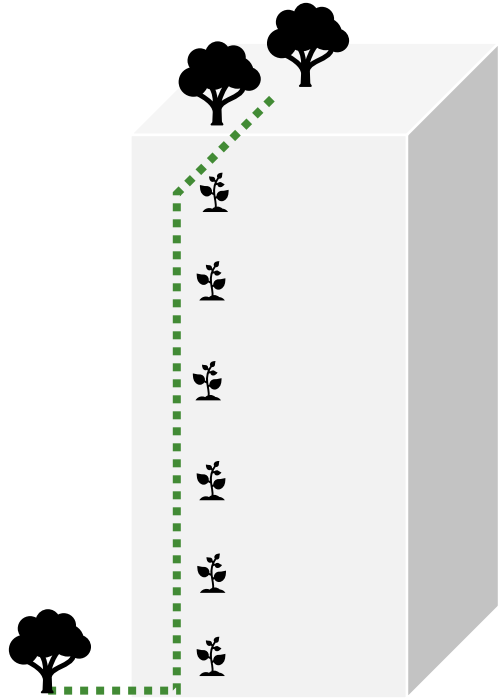
Level 4



Level 5

Biodiversity and biophilia

Appendix E



Diverse green spaces
+ large trees

Nature and biophilia

Five nature related Green Star credits

There are three Green Star credits that are currently being achieved by the The Factory development and require nature impacts to be addressed and nature to be incorporated within the project boundary.

These include:

- Connection to nature – potential to achieve exceptional performance (2 points)
- Biodiversity enhancement – potential to achieve credit achievement (2 points)
- Impacts to nature – targeting minimum expectation

The requirements for these credits are summarised inset and a preliminary review of the design is shown on the following pages

Credit	Target	Requirements	The Factory Design
Connection to nature	Exceptional performance (+2 points)	• Provide views to at least 60% of regularly occupied areas (all areas within 8m of a high quality indoor or outdoor view) • Provide at least 0.05m^2 of indoor plants for every 15m^2 of regularly occupied floor area • Provide at least 5 nature inspired design interventions that are aligned to biophilic principles. • At least 5% of building's floor area or site area must be allocated to nature (whichever is greater)	✓ More than 60% of regularly occupied areas have access to outdoor views of landscaped terraces or balconies ✓ 30m^2 of indoor plants in residential amenities in addition to green roof ✓ Nature inspired design elements include green roof, landscaped terraces, natural building elements, timber
Biodiversity Enhancement	Credit achievement (+2 points)	• At least 15% of the site area or 1:500 GFA for credit achievement • 60% Indigenous plants and no more than 10% from one species, 20% from one genus, 30% from one family • Significant (nesting) tree or equivalent habitat provision per 500m^2 landscaped area • Biodiversity management plan + no invasive species	✓ >700m^2 green space across ground and roof levels, including on new streetscape ✓ 60% indigenous plants with diversity commitments ✓ Strategy for significant nesting tree (or equivalent) to be refined in DD. ✓ Landscape architect will develop biodiversity management plan
Impacts to Nature	Minimum expectation (0 points)	• The building is not built on, or significantly impacts, a site with a high ecological value. • Light pollution must be minimised to neighbouring bodies and to night sky.	✓ Brownfield site ✓ Lighting design will minimise light pollution and comply with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting

Biophilia

Green Star | Connection Nature Credit 15

New to the latest version of Green Star is a Connection to Nature credit which is optional but achievable with nature provided indoors and outdoors and natural building elements and motifs.

In simple terms the requirement is to provide at least 5 nature inspired design interventions that are aligned to several principles.

To demonstrate the criteria is met, it must be evidenced with a narrative of the five nature-inspired design features including design principles setting the project's ambition for connection to nature, along with evidence to support these claims.

Biophilic design principles were explored with the 35-45 Lithgow Street design team, with 6 nature inspired design interventions chosen to be adopted in the design. These interventions are summarised in the following pages.

The implementation of these biophilic principles will be further developed during further design stages.

Green Star Buildings v1

Extract from Green Star Submission Guidelines

Connection to Nature

Healthy

Credit: 15

Points: 2

Outcome

The building fosters connection to nature for building occupants.

Criteria

Credit Achievement	**1 point**	• The building provides views. • The building includes indoor plants and incorporates nature-inspired design. or • 5% of the building's floor area or site area (whichever is greater) is allocated to nature in which occupants can directly engage with.

Nature-inspired design

Five additional nature-inspired design interventions must be provided in alignment with the following principles:

- Elements that provide multiple natural sensory experiences
- Elements that reflect natural and cultural patterns and forms
- Using natural materials
- Large scale and holistically incorporated natural motifs and art

Project teams must provide a narrative against a set of design principles to show how the project's ambition for nature inspired design has been embedded from design concept stage.

Nature inspired design + indoor plants

Nature Inspired Design

The Green Star credit Connection to Nature requires projects to provide at least 5 nature inspired design interventions that are aligned to biophilic principles. To demonstrate the criteria is met, it must be evidenced with a narrative of the features including design principles setting the project's ambition for connection to nature, along with supporting evidence.

The credit refers to the Living Building Challenge's Design Guidebook which can be referred to here and seeks to:

- Include elements that nurture the innate human to nature connection
- Transform projects through deliberate incorporation of nature through *Environmental Features*, *Light and Space*, *Natural Shapes and Forms*, *Natural Patterns and Processes*, and *Evolved Human-Nature Relationships*
- Create a unique connection to place, climate and culture through *Place-Based Relationships*
- Incorporate meaningful integration of public art and design features for human delight celebrating culture, spirit and place
- Have no limitations

The current design's biophilic elements that are aligned with this intent already are:

1. High extent of landscaping across ground floor to the roof
2. Existing building weathered materials
3. Timber elements within material palette
4. Dappled light achieved through varying tree heights and types
5. Indoor/outdoor spa with landscaping creates rainforest feel

The implementation of these biophilic principles will be further developed during further design stages.

Indoor Plants

Provide at least 500cm^2 of indoor plants for every 15m^2 of regularly occupied floor area.

Based on the current design this requirement is therefore >35m^2 by soil area. This is based on a current assumption that the regularly occupied areas amount to ~10,085m^2.

Where this assumption changes the extent of plants required will also change.

Consideration of maintenance and survivability should be given in accommodating this provision.

Natural Features

Place-Based Relationships

Evolving human and nature relationships

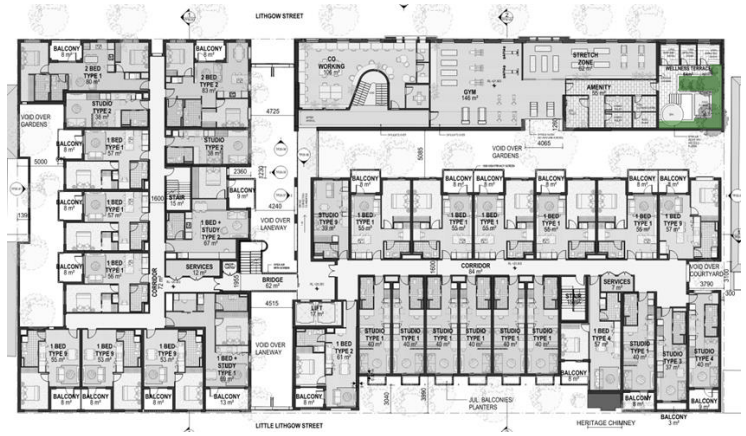
Light and Space

Biodiversity review

~760m^2 landscaping included in the proposed design including on the ground floor, wellness terrace, streetscape and rooftop.
~10m^2 of indoor plants are included in the design at this stage in the amenities building.
>30 trees are included in the design at this stage of varying heights and types. This is assumed to be considered equivalent to large nesting trees.

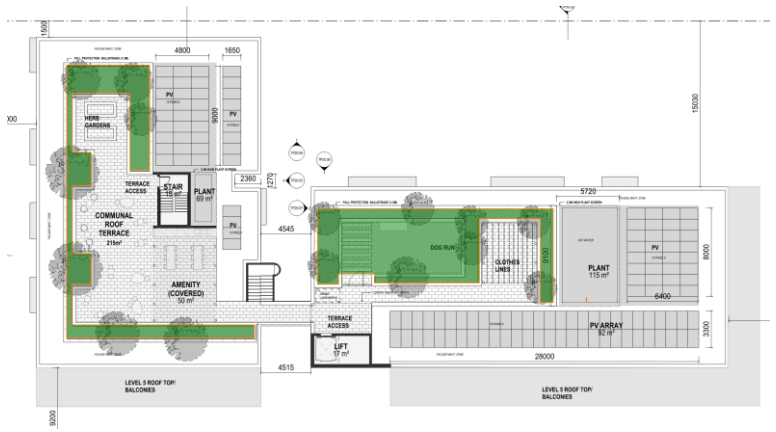
Ground floor

~580m^2 landscaping



Level 1

~16m^2 landscaping

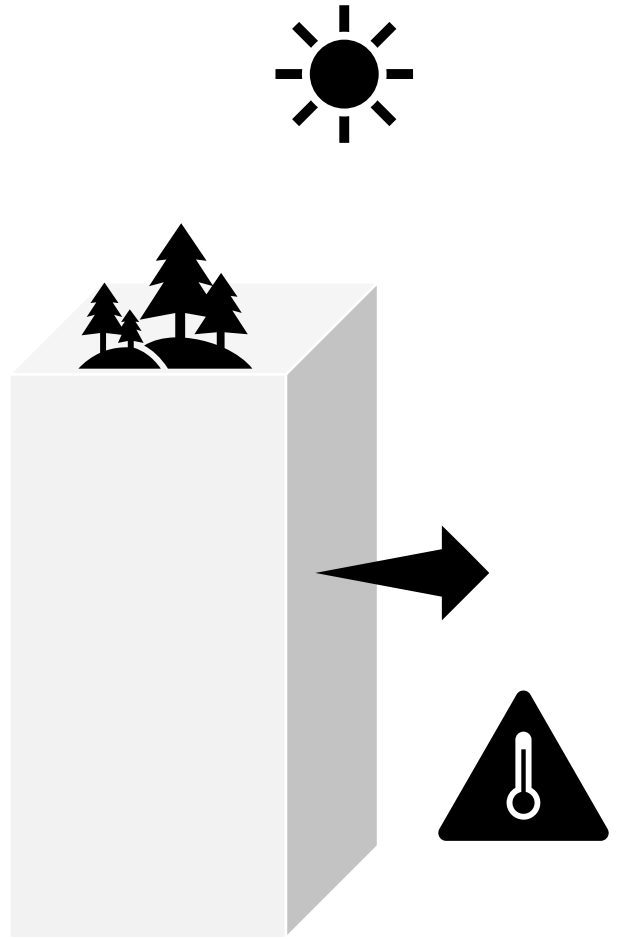


Roof

~180m^2 landscaping

Urban Heat Island

Appendix F



Heat Resilience

Heat island effect reduction

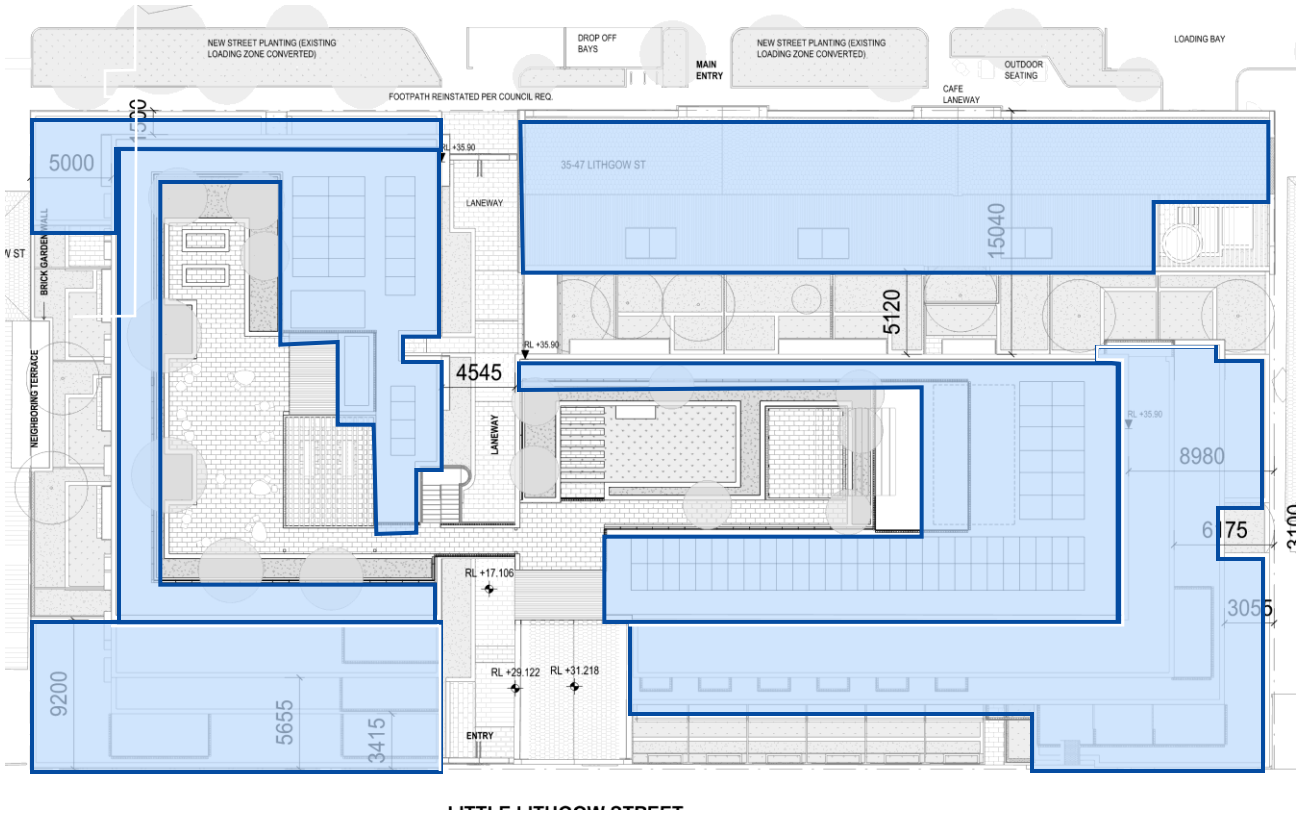
The Green Star Buildings certification rewards projects for reducing the building's impact on the heat island effect. To attain Credit Achievement (1 point), at least 75% of the whole site area comprises of one or a combination of strategies that reduce the heat island effect.

Based on the architectural design, there is approximately 2,115m^2 green space and roof area or >75% of site area that can achieve the credit, if minimum roof SRI values are met. This exceeds the requirement by ~70 m^2. Note that all roof areas must achieve the SRI stated in the figure inset – to be developed as the design progresses. Paved areas (hardscaping) is recommended to also meet the minimum SRI criteria to further improve compliant area.

- Site area: 3,096 m^2
- Roof area (pitched < 15°): 1,785 m^2
- Solar panel area: ~370 m^2
- Landscape area: ~700 m^2
- Paved area: approximately 610 m^2

Assessable area	2,726 m^2 (site area – solar PV area)
Compliant area required	2,045 m^2
Proposed area	2,115 m^2 ✓ Exceeds the requirement by 70 m^2

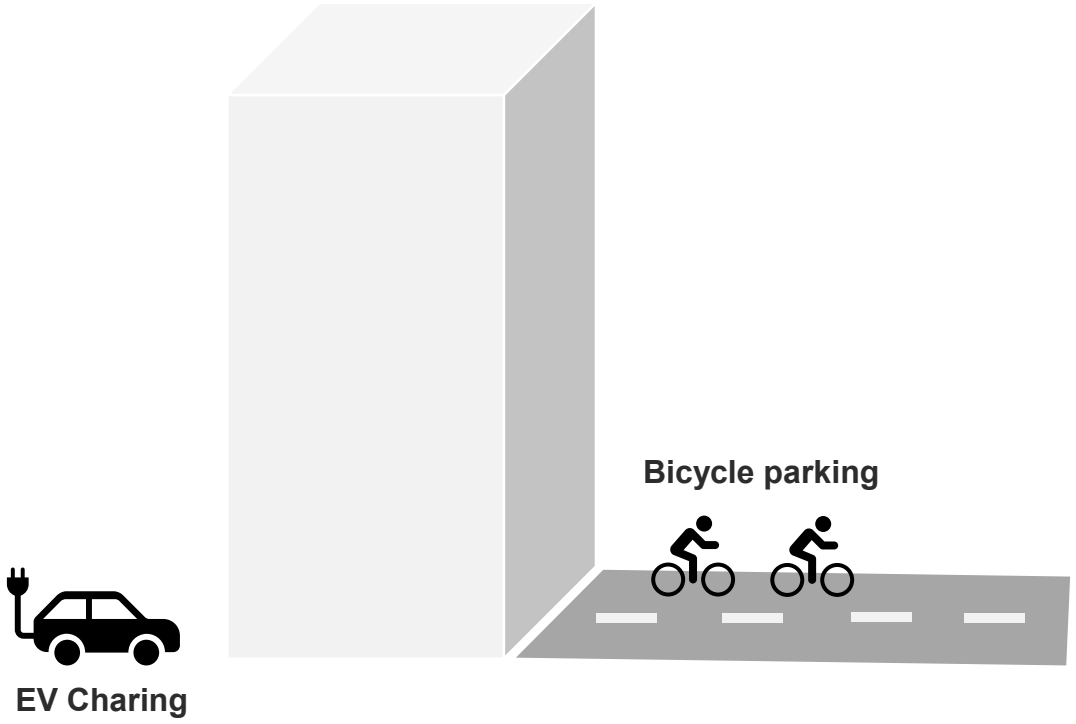
Roof surface materials will be specified to exceed the minimum Green Star 3-Year SRI requirement of 64 using products such as Bluescope Surfmist. (Other areas deemed compliant or shaded or n/a)



Site Plan

Transport

Appendix G



Facilitating sustainable transport

Current data

The 35-45 Lithgow Street development is in the inner Melbourne suburb of Abbotsford and is already well served by public transport. It has the opportunity to further promote active transport modes to all residents by implementing safe and accessible bike parking within the development. As such it is targeting the Green Star credit 27 Movement and Place.

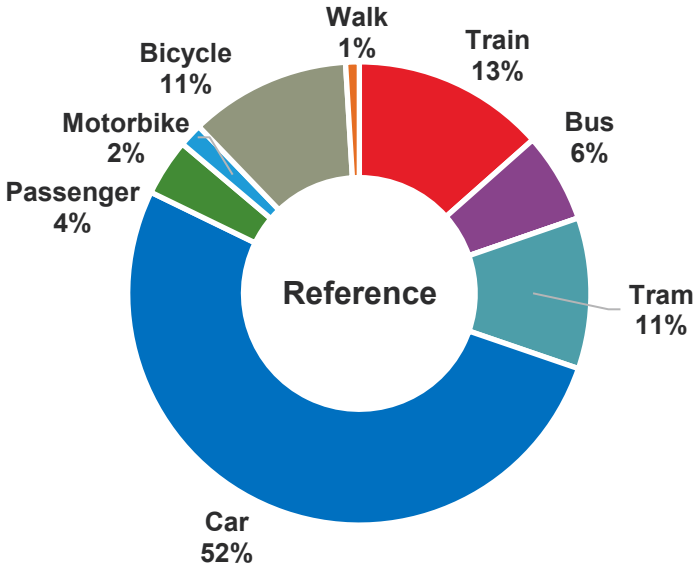
We have used the current Green Star Transport Calculator which may be subject to future updates as the underlying assumptions are out of date and as we haven't registered yet, any changes could affect the calculation process.

The inset data represents the reference transport mix currently assumed for the site which forms the basis for the sustainable transport calculations.

Key details:

- Car use makes the majority of the transport at 52% whilst a further 4% car-share.
- Public transport use is ~30% including trains and buses
- Active transport is ~12% across walking cycling.

Transport mix (assumed as per Green Star)



Facilitating sustainable transport

Proposed interventions

Based on the following design assumptions, the design requirements are as shown inset:

- 43 carparks are included in the rating boundary (therefore ~20% have the ability to park a car onsite)
- The number of total building occupants is estimated to be 219 on the basis of the number and type of apartments and aligns with other Green Star credits.

The resulting transport mix meets the 3 Green Star criteria for Movement and Place as shown inset.

Design requirements and credit results

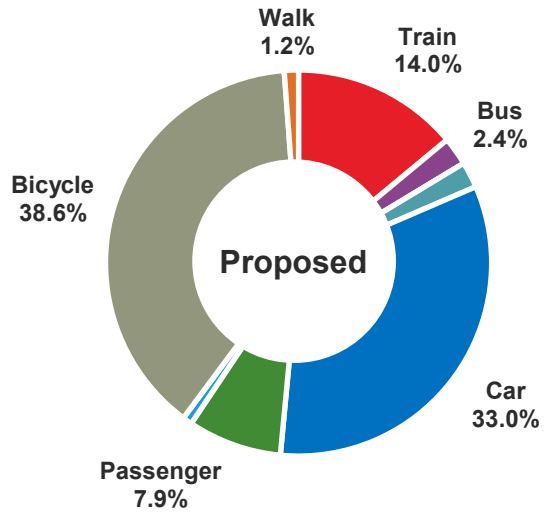
90 bike parks (~40% of residents)

3 EV charging spaces (5% of carparks)

40 future EV charging spaces to all remaining carparks (subject to fire risk)

1 car-share space

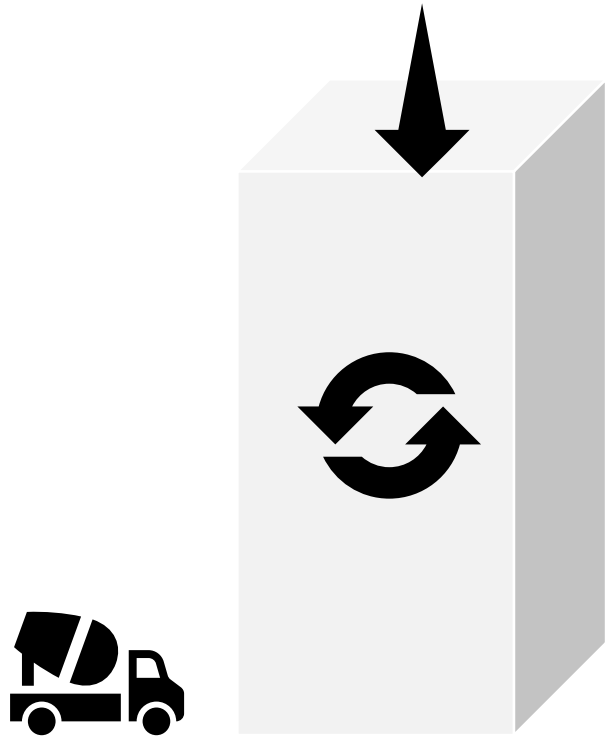
Resulting transport mix



Green Star criteria	Result	Met
Vehicle emissions reduction (>40%)	41%	✓
Active transport mode encouragement (>90%)	227%	✓
Reduction in vehicle kilometres travelled (>20%)	36%	✓

Materials + Upfront Carbon

Appendix H



Reduction in Upfront Carbon

Responsibly Sourced + Low Carbon

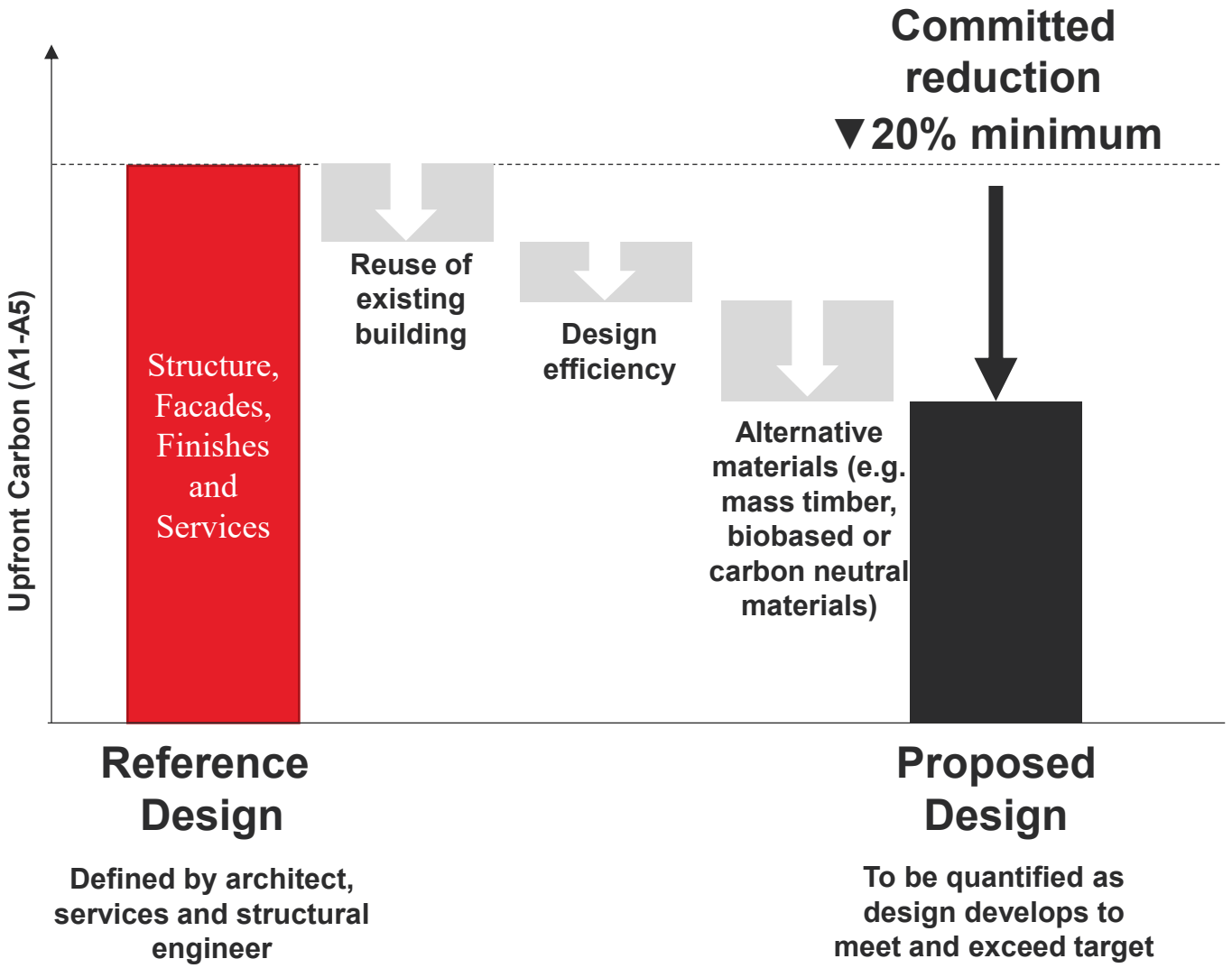
35-45 Lithgow Street must achieve a minimum 20% reduction in upfront carbon, required under the Climate Positive Pathway for any 5 star Green Star projects registered from 2023 (credit 21).

As a stretch target the project is considering a higher target of 50%, to reflect its ambition of regenerative decarbonisation but this is not a planning commitment at this stage.

A reference design will be established that is a hypothetical building of same size, shape, location, floor area + glazing areas as the proposed (per EN 15978:2011). This design is then optimised and improved upon to demonstrate an overall carbon reduction, summarised in the figure inset.

The resulting materials must be specified and procured with emerging best practice 3rd party certifications in line with the requirements of the responsible materials credits (credit 6).

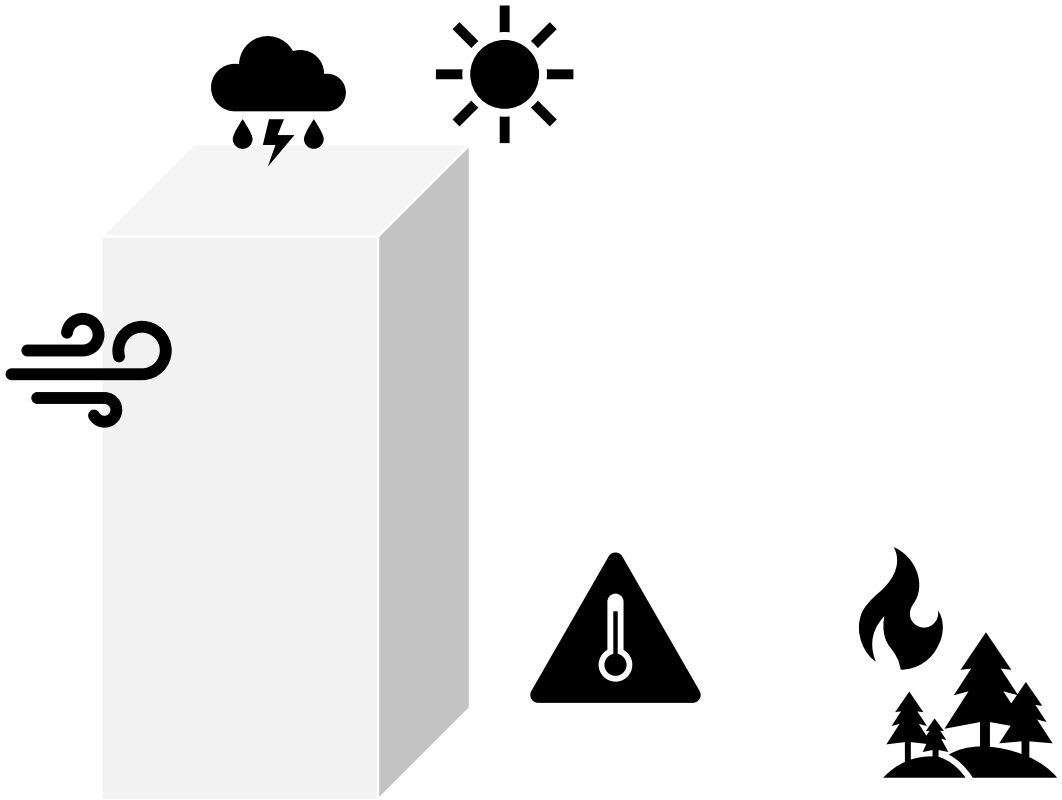
Several strategies have been discussed to achieve this reduction in upfront carbon, summarised inset and on the subsequent pages. This is a preliminary carbon reduction strategy, which will be further refined during design development with the project team.



ARUP

Climate Resilience

Appendix J



Climate Change Screening

Climate Resilience

Introduction

What is climate resilience?

Climate change is a global economic, social, environmental, and public health issue that poses significant consequence for our health and wellbeing. In Victoria, we are already experiencing the cascading effects of climate change including increasing drought, bushfires, floods, and higher average temperatures. While reducing our emissions will lessen the magnitude of future climate change, it is vital that our buildings and communities are designed to be resilient to the climate change already locked in.

This document highlights potential climate-related impacts to Model's The Factory project that have been identified through a preliminary climate risk screening process. It explores current and future climate projections for the Abbotsford site, identifying direct and indirect risks that may impact the development over its lifetime. These will be assessed in the next stage as part of the climate change risk and adaptation assessment.

Adaptation measures to reduce and mitigate priority risks will also be developed in a comprehensive resilience workshop with the project team in the project's next stage.

Following the workshop, a Climate Change Adaptation Plan will be developed to inform the design team of risks and mitigation strategies to future proof the buildings, infrastructure, and landscapes.

Credit: Mika Baumeister

Unsplash

Why design for the future?

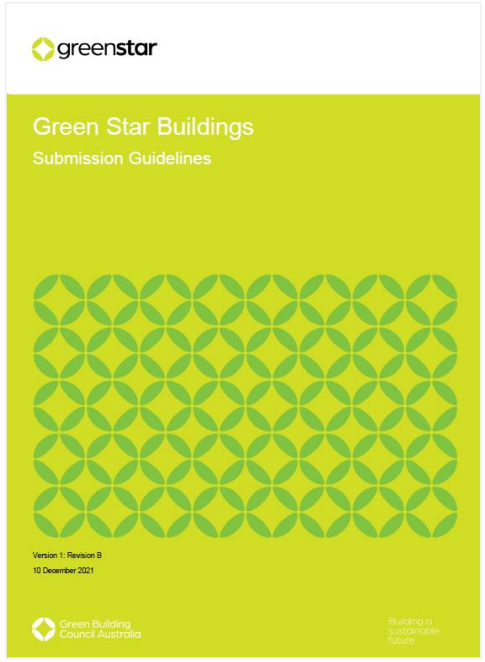
Climate Change Adaptation Plans

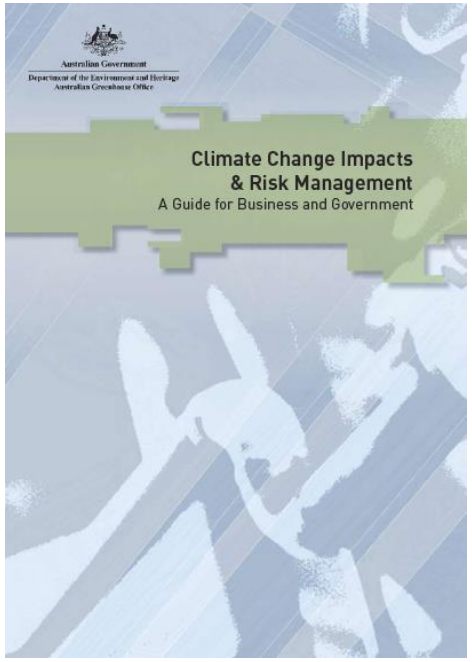
Climate change adaptation plans are a tool for understanding:

- Current and future climate conditions
- Any associated direct and indirect impacts
- Impacts that pose a high risk to the structure or operation of the building (including users)
- Adaptation measures to reduce priority risks

Benefits include:

- Ensuring the building performs well under future climate
- Reducing cost of damage from climate-related events
- Maintaining tenant satisfaction
- Reducing operating expenditure, including potential insurance costs
- Minimising retrofit costs





Recognised Standards Referenced in the Study

Why Assess Climate Risk?

Drivers of climate change adaptation

The drivers for undertaking a climate change risk assessment and adaptation plan include:

- Developments built to withstand historical climate are increasingly unlikely to be resilient to future climate.
- Property sector is increasingly appreciating the risk that climate change presents to businesses now and in the future
- Supports corporate reporting disclosures related to climate risk
- Financial exposure
- Financial risk of climate change – APRA
- Stakeholder and shareholder expectations
- Market drivers e.g. insurance premiums, tenant comfort, operational expenditure

Green Star buildings requires a climate change pre-screening checklist as a minimum expectation and offers +1 point for developing a Climate Change Adaptation Plan.

Green Star Buildings | Resilience

Green Star – Resilient

Green Star is Australia's trusted mark of quality for the design, construction and operations of healthy, resilient, and positive buildings, fitouts, communities, and homes.

Green Star's mission is to "lead the sustainable transformation of the built environment". Green Star aims to achieve this by encouraging practices that:

• Reduce the impact of climate change

• Enhance health & quality of life

• Restore and protect our planet's biodiversity and ecosystems

• Drive resilient outcomes for buildings, fitouts, communities, and homes

• Contribute to market transformation and a sustainable economy

Climate Change Resilience (Credit 16)

The *Resilient* category allows building owners to demonstrate to investors and the community that risks that threaten the short- and long-term performance of the building have been considered. The intended outcome of this credit is that the building has been built to respond to the direct and indirect impacts of climate change.

Climate Change Pre-screening Checklist (ME)

For minimum expectation, the project team completes the climate change pre-screening checklist. The project team communicates the building's exposure to climate change risks to the applicant. Project team members must consider potential impacts from climate change when completing the checklist in the submission form including, but not limited to:

- Direct damage or failure of project components
- Accelerated deterioration of project components or reduced design life
- Reduced operating capacity
- Climate hazard impacts to surrounding areas (e.g., impacting access and egress)
- Impacts to the health and wellbeing of building occupants and other relevant stakeholders
- Indirect risks from impacts to other interdependent systems and services (e.g., transport networks, power, water, telecommunications)

Both historic and future data must be used when completing the checklist. All sections must be completed. The Minimum Expectation is achieved on completion of the checklist and doesn't require identified risks to be treated.

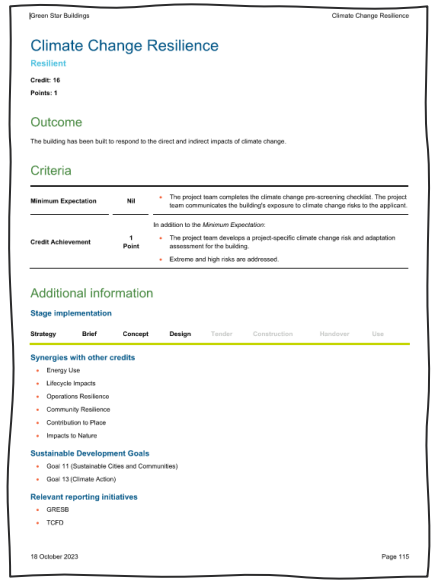
This study is the focus of this report.

Address Climate Change Risk and Adaptation (Credit)

For Credit Achievement, the project team develops a project-specific climate change risk and adaptation assessment for the building. Extreme and high risks are addressed.

A suitably qualified professional must undertake a climate change risk and adaptation assessment and author a report.

This will be undertaken as a follow up study and is not the focus of this report.



|Green Star Buildings | Climate Change Resilience

Climate Change Resilience

Resilient

Credit: 16

Points: 1

Outcome

The building has been built to respond to the direct and indirect impacts of climate change.

Criteria

Minimum Expectation	Nil	• The project team completes the climate change pre-screening checklist. The project team communicates the building's exposure to climate change risks to the applicant.
Credit Achievement	1 Point	In addition to the *Minimum Expectation*: • The project team develops a project-specific climate change risk and adaptation assessment for the building. • Extreme and high risks are addressed.

Additional information

Stage implementation

Strategy | Brief | Concept | Design | Tender | Construction | Handover | Use

Synergies with other credits

- Energy Use
- Lifecycle Impacts
- Operations Resilience
- Community Resilience
- Contribution to Place
- Impacts to Nature

Sustainable Development Goals

- Goal 11 (Sustainable Cities and Communities)
- Goal 13 (Climate Action)

Relevant reporting initiatives

- GRESB
- TCFD

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Data and Methodology

To understand the future effects of climate change, specific emissions scenarios and assessment time horizons need to be selected that are appropriate for the asset design, construction, and operational timescales of the development and represent best available climate data.

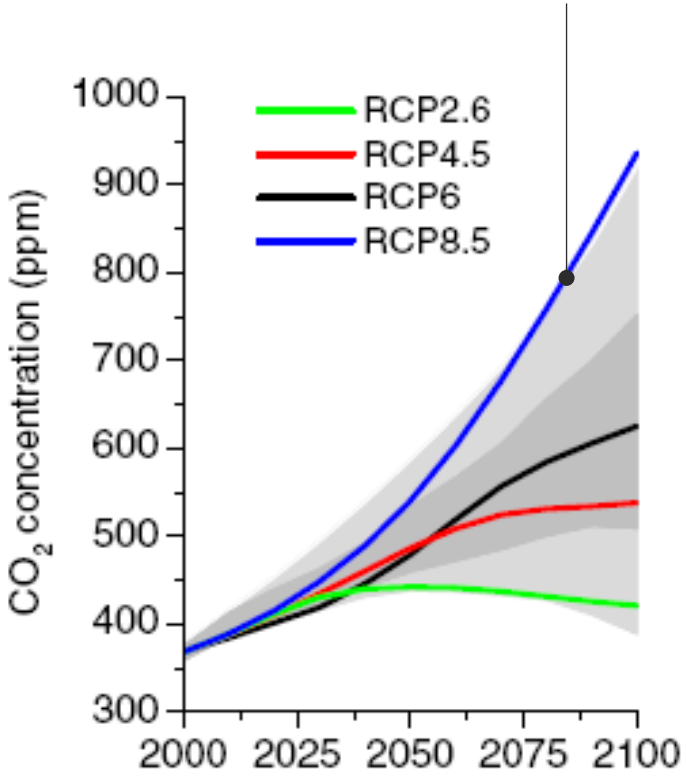
According to the Australian Building Codes Board (ABCB), the design life for a normal building is 50 years. Depending on the accessibility and cost to replace or repair different sub-systems of a building, the design life ranges from 5 to 25 years. As such, the following emissions scenarios and time horizons have been used for this assessment:

- 2030 under RCP8.5
- 2070 under RCP8.5 (assuming a minimum design life of 50 years)

Representative Concentration Pathway (RCP) 8.5 is a scenario used in climate modeling and projections and represents the most conservative approach. It assumes a high level of greenhouse gas emissions throughout the 21st century, leading to a radiative forcing of 8.5 watts per square meter by the year 2100. RCP8.5 corresponds to the pathway with modest rates of technological change and energy intensity improvements, leading in the long term to high energy demand and greenhouse gas emissions with weak climate policy commitments in Australia (business as usual).

Additional details supporting these assumptions have been provided on the following page.

RCP 8.5 used to derive climate projections for this project.



Trends in concentrations of carbon dioxide (right). Grey area indicates the 98th and 90th percentiles (light/dark grey) of the values from the literature. SOURCE: van vuuren et. Al. (2011))

Climate Change Projections

Selected emissions scenario

Climate change scenarios refer to a coherent, plausible and simple description of possible future state of the climate, which forms the basis of climate change projections.

Four representative concentration pathways (RCPs) were published in the Intergovernmental Panel on Climate Change's (IPCC's) Fifth Assessment Report (AR5). These scenarios are defined by their total radiative forcing (cumulative measure of human greenhouse gas emissions, expressed in Watts per square metre (W/m^2)) by 2100. These scenarios are: RCP2.6, RCP4.5, RCP6, and RCP8.5 corresponding to +2.6, +4.5, +6.0, and +8.5 W/m^2, respectively.

Climate models suggest that global surface temperature change for the end of the 21st century is likely to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6.

For this project, RCP8.5 has been used to derive climate projections.

Source data

Climate change projections for this report have been consolidated from the Victorian Climate Projections 2019 (VCP19) Technical Report and VCP19 datasets for urban centre: Melbourne, published by CSIRO and the State of Victoria. These datasets are also captured in the Victoria's Future Climate Tool.

The datasets feature a dynamically downscaled set of simulations based on the Conformal Cubic Atmospheric Model (CCAM), as well as drawing on the full range of outputs from Climate Change in Australia (CCIA) using global climate models and other climate modelling data sets.

AR5 was released in 2012/13 and this draws on the latest round of coordinated global climate models known as CMIP5 released in 2011/12, among many other lines of evidence. The CCIA climate projections draw on the science and model simulations from this period, as well as drawing on high-resolution climate modelling based on the CMIP5 outputs. VCP19 uses the same CMIP5 outputs, as well as new high-resolution climate modelling, combined with subsequent research and observations.

During the next stage of the project, this assessment will be updated to reflect CMIP6 which has recently been downscaled for Victoria and represents the latest climate projections.

Selected climate models

For this project, temperature and rainfall projections are based on HadGEM2-CC. This represents the comparatively hottest and driest climate future (least cool and wet) for Victoria for downscaling regional climate.

Climate projections for solar radiation and wind are based on CESM1-CAM5. This represents the worst-case scenario in terms of increasing solar radiation for Melbourne. Projections have been provided as the median values.

The selected calculation method for heatwaves is Excess Heat Factor (EHF). EHF is an objective definition for heatwaves and heatwave severity that may be applied to any location. Using this definition, it is possible to compare severe and extreme heat events across time and space. It combines measures of excess heat, the long-term temperature anomaly characterised by each location's unique climatology of heat, and heat stress, the short-term temperature anomaly measuring recent thermal acclimatisation. These two measures are then factored together to create the excess heat factor (EHF).

Climate Change Projections for Melbourne

Projected changes in climate variables

Hazard	Indicator	Baseline 1986-2005	Projections RCP8.5 2030	Projections RCP8.5 2070
Extreme heat	*Annual mean temperature (°C)*	14.16	15.44	17.41
	Annual mean max. temperature (°C)	19.23	20.97	23.48
	Annual mean min. temperature (°C)	8.85	9.79	11.54
	Maximum temperature - 20-year return period (°C)	41.66	45.00	47.96
	Number of hot days (>35 °C)	5.75	13.8	29.1
	Number of cold nights (<0 °C)	1.23	0.64	0.05
	Number of heatwaves	1.52	3.94	8.1
	Sum of heatwave days	10.52	20.78	49.43
Solar Radiation	*Change in Solar Radiation (% change in w/m^2)*	-	+3.90	+3.90

Climate Change Projections for Melbourne

Projected changes in climate variables

Hazard	Indicator	Baseline 1986-2005	Projections RCP8.5 2030	Projections RCP8.5 2070
Flood	*Precipitation - 5% AEP (mm)*	91.86	93.76	111.9
	Rainfall intensity	Given the uncertainty in rainfall projections and their considerable regional variability, an increase in rainfall (intensity or depth) of 5% per °C of local warming is recommended.[1] Rainfall intensity is therefore projected to increase by 11.9% by 2070 under RCP8.5.[2] Annual frequency of severe thunderstorm days is likely to rise by 22% by 2100.[3]		
Wind	*Annual mean wind speed change*	-	+5.5%	+6.7%
Drought	*Drought factor (scale of 1-10)*	6.2	6.6	7.4* *by 2090
	Annual rainfall (mm)	730.53	617.05	505.27
Humidity	*Relative humidity change (%)*	-	-1.94	-2.69
Bushfire	*Severe fire danger days (FFDI > 50, days per year)*	2.8	3.4	5.3* *by 2090
Sea-level rise	*Sea-level rise (m)*	-	+0.20	+0.82

[1] Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia), 2019.
[2] Interim climate change factors; https://data.arr-software.org/
[3] https://www.climatecouncil.org.au/uploads/3ca765b1c65cb52aa74eec2ce3161618.pdf

Localised Climate Context Abbotsford

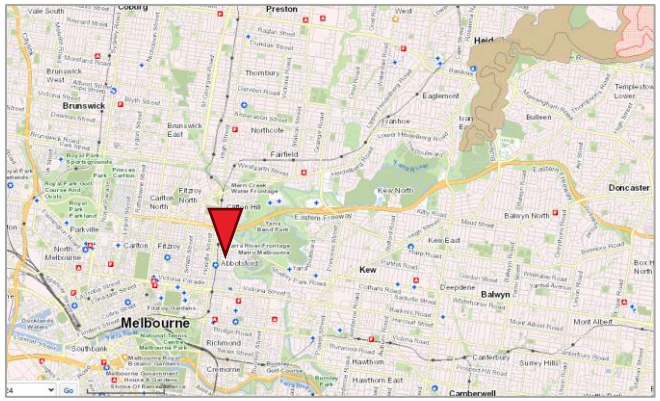
Adjacent to bushfire and flood prone areas

The location of Models' Lithgow St project in Abbotsford has been reviewed against available data for the local climate.

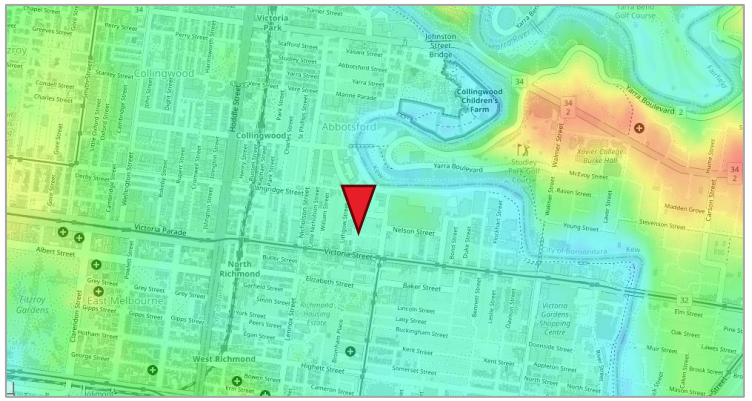
The site is not located in a bushfire prone area, however due to the proximity to bushfire prone areas to the north and east, the impact of smoke and air quality is a consideration.

Additionally, the project is not located in an area that is considered at risk of experiencing a 1% chance of annual flood event, as highlighted by the Land subject to inundation Flood Map (VicPlan). However, the site is subject to localised flooding up to 0.5m or speed up to 2m/s from council drains. Pluvial flooding could be experienced toward the west of the site as well as the basement areas, which should be highlighted as a risk.

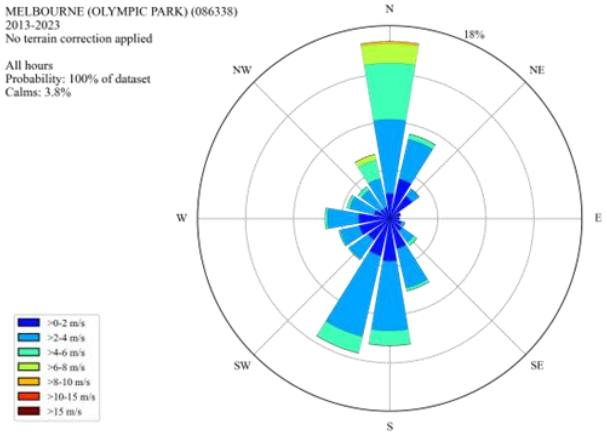
A review of the wind rose for the nearest weather station (Melbourne Olympic Park), which is based on historical data, highlights that the site is not at risk of experiencing damaging winds (>8m/s). Under some climate models, wind speed is projected to increase in Melbourne and therefore due consideration of appropriate wind-loading and avoidance of wind tunnels should be given during design.



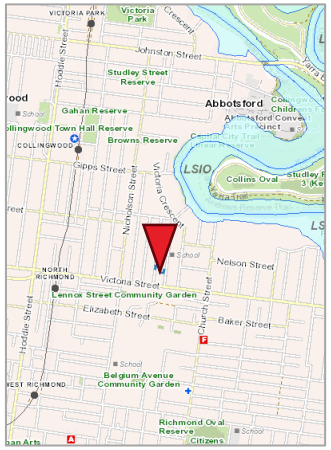
Designated Bushfire Prone Area (BPA), VicPlan[1]



Topography map[2]



Extract from Arup's Wind projection tool



Land subject to inundation overlay (LSIO), VicPlan[1]

Stormwater flooding council drains, Yarra flood mapping[3]

[1] Designated Bushfire Prone Area (BPA) Simplified for Victoria , Department of Transport and Planning, Sep 2023, Vicplan
[2] https://en-au.topographic-map.com
[3] https://experience.arcgis.com/experience/09539148379b45e79ad42747f856668d#data_s=id%3Awidget_10_output_config_widget_1-dataSource_3_0%3A0

Potential Climate Impacts for The Factory

Non-exhaustive list of potential climate-related impacts for relevant hazards

Hazard		Impact	2030	2070
Extreme heat		Direct	• Rising temperatures impact on thermal performance of buildings and reduce thermal comfort for occupants both in indoor and outdoor spaces. • Increased temperatures leads to increased HVAC system power demand to support enhanced thermal loads, results in more frequent peak load. • Temperature extremes impacting on soil expansion and contraction cycles, causing structural damage to structures and hardscaping. • Increased risk of loss of grid connectivity in extreme weather events • Human health effects including fatigue and heat stress, heightened for elderly, children and those with existing health conditions	
Flooding		Direct	• Increased rainfall intensity leading to localised flooding and capacity issues in existing drainage infrastructure, causing damage to the buildings structure and ground-based services, and causing disruption to building occupants. • Impacts to accessibility of the site and power supply caused by flooding	
Wind/ Storm		Direct	• Extreme weather conditions leading to increased structural load on buildings and damaging buildings and structures • Extreme weather events may lead to trees dying or dropping limbs, causing safety risk for staff, residents, and visitors.	
Solar radiation		Direct	• Minimal increase in solar radiation may lead to materials degrading at an increased rate	
Drought		Indirect	• Decreased rainfall impacting future operational costs and amenity of the site • Reduced rainfall days will reduce removal of atmospheric pollutants leading to poorer health outcomes • Decreased levels of soil moisture, impacting building foundations (such as movement)	
Bushfire		Indirect	• Smoke affecting outdoor air quality and amenity for residents and infiltrating indoor spaces through ventilation and building mechanical systems. • Bushfire events may lead to power restrictions or failures, causing temporary or extended power outages.	
Humidity		Negligible	• The projected decrease for relative humidity is small and is therefore unlikely to have an impact on the development.	
Sea level rise		Negligible	• Sea level rise will not present a direct impact for this development	

Climate Change Pre-screening Checklist

Risks assessed under past and future climate exposure

The 35-45 Lithgow Street site in Abbotsford has been assessed against potential climate risks. The outcome of this review is shown inset, highlighting where material hazards have been identified.

Risks impacts were not individually assessed during this stage and therefore no risk treatments have been identified as yet. Adaptation opportunities for priority risks will be explored in the Resilience workshop during the next project stage that will be facilitated by Arup.

Some important things to note that this stage:

- While the project area has not previously been impacted by extreme events, a review of future climate data highlights potential future risk, particularly with regards to extreme rainfall and flooding, heatwaves and drought.
- While the project is not located in a designated flood prone area, due to site topography there is a risk of pluvial flooding in the basement areas and along the west border of the site.
- The project is not located within a bushfire prone area, however, is within 10 km of potentially affected areas and as such could be impacted with poor air quality, particularly with winds prominent from the north.
- The development's occupants may include young children who are at high risk of being impacted by extreme weather events.

Pre-screening item	Applies to project	Has data regarding future climate exposure been reviewed?	Has a risk to the project been identified?	Has a risk treatment been identified?
The project area has previously been impacted by extreme climate events (e.g. storms/tropical cyclones, extreme rainfall and flooding, damaging winds, damaging hail, bushfires, heatwaves, drought, or coastal inundation).	No	Yes	Yes	Passive design measures.
The project is located in a cyclone zone.	No	NA	NA	NA
The is project located in or adjacent to a bushfire prone area.	No	Yes	Yes	Filtered fresh air strategies.
The project is located in or adjacent to a flood prone area.	Yes	Yes	Yes	Water retention strategies.
The project is located at or adjacent to the coastline or tidally influenced waterway.	No	NA	NA	NA
The project will accommodate occupants vulnerable to the impacts of climate extremes (e.g. children, elderly, low mobility, seeking medical treatment).	Yes	Yes	Yes	Passive design measures and operational strategies.

Climate Pre-Screening Checklist

Following Green Star Buildings v1 Methodology

Overview + Next Steps

Summary of Identified Risks

This preliminary climate risk screening has highlighted that when considering current and future climate data, there are several climate-related hazards which may pose risks to Model's 35-45 Lithgow Street project, including:

- Potential future risk associated with extreme rainfall that could leading to localised flooding and capacity issues in existing drainage infrastructure, causing damage to the buildings structure and ground-based services, and causing disruption and site access issues for building occupants at the Little 35-45 Lithgow Street entrance. There is potential risk of pluvial flooding toward the west of the site and basement.
- Heatwaves could impact thermal performance of the buildings as well as occupant comfort and health with fatigue and heat stress more likely. Building structure could also be impacted by soil expansion and extraction associated with higher temperatures and drought.
- The project is not located within a bushfire prone area, however, is within 10 km of potentially affected areas and as such could be impacted with smoke and associated poor air quality.
- The development's occupants are expected to be varied with potentially elderly and children, who are at high risk of being impacted by extreme weather events.

Next Steps

Following Model's review of this preliminary climate change screening, Arup will undertake a full climate change risk assessment to identify priority risks for treatment. Priority risks will be validated with the project team in a Resilience Workshop and appropriate design and operational adaptation measures will be determined.

The climate risk and adaptation assessment will be undertaken by Arup's Climate Change Specialists who will author a Climate Change Adaptation Plan as that reflects the assessment and the project's adopted strategies. This may fulfill requirements of Green Star Credit 16 Climate Change Resilience dependent on initiatives implemented by the project team.