CUNDALL

91-93 Canning Highway, East Fremantle

Sustainable Design Assessment Report

Builtform Projects

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Executive summary

The 91-93 Canning Highway development is a mixed use multiple residential and commercial development. The location of the development lies within the Town of East Fremantle local area boundary and this report outlines the Ecological Sustainable Design (ESD) strategy for the proposed development and how the project meets the requirements of the relevant planning Policies, Strategies and Guidelines. The policies and guidelines considered for this report are:

1. Town of East Fremantle Local Planning Scheme
2. Western Australian Climate Policy

In addition to meeting the requirements and targets outlined in the documents listed above, this development also aims to demonstrate its achievement of positive sustainability outcomes with

- A 5-star Green Star Buildings certification
- An average 8-star NatHERS rating across the residential component of the development
- A 5-star NABERS Energy rating for the commercial spaces
- Net zero carbon for Scope 1 and 2 emission in the building's operations

The sections below confirm that the proposed development responds to these requirements and outlines which sections of this report are relevant for each requirement.

Town of East Fremantle Local Planning Scheme

Development must demonstrate that:	Requirement will be met	Comments
Section 3: Aims and Objectives **3.5 Environmental Resources** In light of the characteristics and issues • To conserve and enhance the natural environmental qualities of the Town by providing a basis for incorporating environmental principles into public and private decision making; • To promote the protection of existing native flora where practicable and to encourage the enhancement of existing 'green' belts based on private yard areas and landscaping of public spaces • To encourage the development of a more ecologically sustainable urban system based on protection of air and water quality and the maintenance of natural biological systems.	✓	The project responds to all three requirements. Refer to Sections 5.0 and 8.0

Western Australian Climate Policy

Applicable action or target	Requirement will be met	Comments
Transition towards net zero by 2050	✓	Refer to Section 2.0
Energy efficient social housing, reducing carbon emissions. Aiming to achieve a 7-star Nationwide House Energy Rating Scheme (NatHERS) rating for new single and grouped dwellings constructed under the Housing Stimulus Program	✓	The project targets an average 8 Star NatHERS rating reducing the energy requirements of the project by 44% Refer to Section 5.1.1
Climate Resilience Action Plan 2022–25 Develop a coordinated, collaborative plan to support Western Australian industries, cities and regions to identify and manage climate impacts and enhance climate resilience.	✓	Refer to Section 3.0

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1.0 Introduction

The 91-93 Canning Highway development is a mixed-use multiple apartment and commercial space development. The proposed 19-storey building on Canning Highway, East Fremantle comprises 95 apartments and approximately 12, 000 m^2 of commercial space across the ground, first, and second floors; in addition to a café on the ground floor. Community spaces include a lobby on the ground floor, and a pool and gym on the third floor of the development.

The location of the development lies within the Town of East Fremantle local area boundary and this report outlines the Ecological Sustainable Design (ESD) strategy for the proposed development and how the project meets the requirements of the relevant planning Policies, Strategies and Guidelines.

The policies and guidelines considered for this report are:

1. Town of East Fremantle Local Planning Scheme
2. Western Australian Climate Policy

Figure 1.1.1 Visualisation of the Proposed 91-93 Canning Highway development

1.1 Town of East Fremantle Local Planning

The purpose of the Town of East Fremantle Local Planning Scheme is to set out the long-term strategic direction for land use and development within the Town of East Fremantle. The relevant Sections for the sustainable design of the development are:

Section 3: Aims and Objectives

3.5 Environmental Resources

- In light of the characteristics and issues
- To conserve and enhance the natural environmental qualities of the Town by providing a basis for incorporating environmental principles into public and private decision making;
- To promote the protection of existing native flora where practicable and to encourage the enhancement of existing 'green' belts based on private yard areas and landscaping of public spaces
- To encourage the development of a more ecologically sustainable urban system based on protection of air and water quality and the maintenance of natural biological systems.

1.2 Western Australia Climate Policy

Western Australia's Climate Policy produced in November 2020 by the Government of Western Australia is a policy to commit to a low carbon future for Western Australia. Relevant actions from the Climate Policy are:

Energy efficient social housing, reducing carbon emissions:

- Aiming to achieve a 7-star Nationwide House Energy Rating Scheme (NatHERS) rating for new single and grouped dwellings constructed under the Housing Stimulus Program

Climate Resilience Action Plan 2022–25:

- Develop a coordinated, collaborative plan to support Western Australian industries, cities and regions to identify and manage climate impacts and enhance climate resilience.

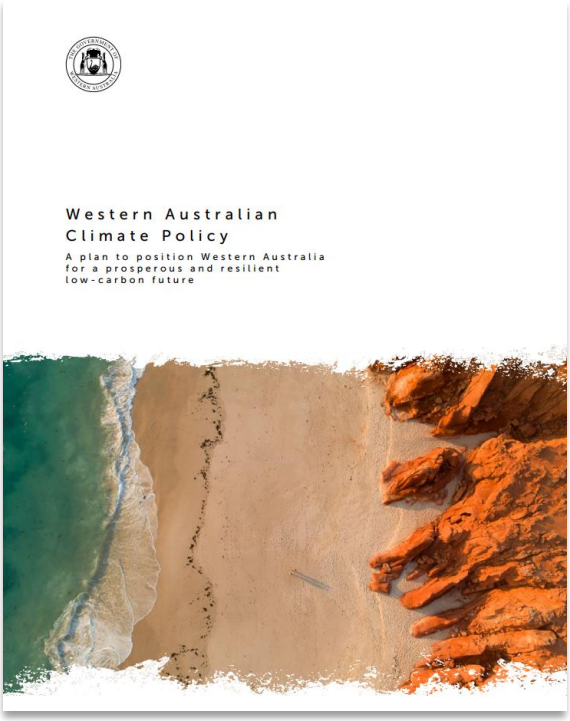

Figure 1.2 WA Climate Policy, November 2020

1.3 Sustainability targets

In addition to targeting the requirements and targets outlined in the documents listed above, this development will also investigate further positive sustainability outcomes:

- Targeting a 5-star Green Star Buildings certification which would be one of the first in Western Australia.
- An average 8-star NatHERS rating across the residential component of the development
- 5-star NABERS Energy rating for the commercial spaces
- Net zero carbon for Scope 1 and 2 emission in the building's operations

These commitments are outlined in more detail in the following sections of this report.

2.0 Net zero carbon

The construction industry is responsible for around 20% of Australia's carbon footprint. These emissions include embodied carbon emissions, energy and water consumption that goes into the building during construction as well as operational energy and water usage of the completed building, maintenance during the life span and the demolition at the end of the building's life.

The Government of Western Australia outlines their aspirations to achieve net zero greenhouse gas emissions by 2050 in their Climate Policy published in November 2020.

The 91-93 Canning Highway development is investigating targeting zero carbon emissions for Scope 1 and 2 emissions in its operations from day one.

2.1 Initiatives

The following table summarises the specific initiatives being investigated for the development included in the design in relation to achieving Net zero carbon.

Table 2.1 Net zero carbon initiatives

Item	Design initiative included in the development's design
Energy efficiency	An average 8 Star NatHERS rating is targeted for the residential component of the building translating into 44% less energy use required for the apartments.
No fossil fuels	Investigation for no gas being used for space heating, domestic hot water or cooking.
Renewable energy	It is investigated that 100% of the building's energy could come from renewables such as GreenPower.
Emissions from refrigerants	Emissions from refrigerants are eliminated as far as possible
Carbon neutrality	A carbon neutral certification under the Climate Active Carbon Neutral Standard for buildings is being considered

2.2 Energy efficiency

Refer to chapter Energy efficiency

2.3 No fossil fuels

As a fossil fuel, natural gas releases significant amounts of greenhouse gas emissions contributing to the negative effects of climate change when burnt in a building for cooking or heating. The 91-93 Canning Highway development is investigating to design the building with no fossil fuels being used including natural gas.

2.4 Renewable energy

The project is targeting to procure all energy used from renewable source. This may be either GreenPower or onsite renewables such as Solar PV. At the current stage, 30kW PV cells are being investigated for use, with provisions for batteries.

2.5 Emissions from refrigerants

Synthetic refrigerants are made up of chemicals that have a high global warming potential (GWP). GWP is the relative amount of degradation the refrigerant can cause to global warming. Because of this, refrigerants must be safely disposed at the end of their life at great cost. In the future building owners may be impacted by future requirements for safe disposal which may include increases in penalties that should be considered today[1].

The elimination of high-GWP refrigerants is being investigated for the development, to minimise the environmental and climate impacts of these refrigerants. This will involve the apartments and commercial areas being cooled through good passive design, cross ventilation and a high thermally performing building envelope. The implementation of these key design solutions would omit the need for using active air conditioning units and reduce the use of climate harming refrigerants significantly.

2.6 Carbon neutrality

The Australian Government's Department of Industry, Science, Energy and Resources has launched the Climate Active Carbon Neutral Standard (former National Carbon Offset Standard) in 2019 to partner with organisations throughout Australia to drive voluntary climate action. The Standard has been recognised as one of the most rigorous in the world by the European Union Commission and the World Bank.

The Standard is available for organisations, precincts, buildings, products, services and events and can be paired with a formal Carbon Neutral certification through Climate Active.

The Climate Active carbon accounting principles are based on those outlined in the GHG Protocol – Corporate Standard (WBCSD and WRI, 2004) and international standards, including the AS ISO 14064 and ISO 14040 series and include the assessment of a holistic range of emission sources, including energy, water, waste and travel.

The project is exploring the option to certify the building carbon neutral under the Climate Active Standard in its operations.

[1] GBCA: Green Star Buildings v1

3.0 Resilience

Our communities and systems can be disrupted at any time by the impacts of events such as extreme weather, cyber-attacks and terrorism, or even significant infrastructure failure. Acute shocks such as the 2019-20 bushfire season and the global spread of COVID-19 highlighted just how interconnected we are as people, communities and economies, and just how reliant we are on interdependent assets and services to move, work, play and thrive[2].

Because this development incorporates a community/public area in addition to a café, resilience is a key driver behind the sustainability concept of the project.

3.1 Initiatives

The following table summarises the specific initiatives being investigated for inclusion in the design in relation to resilience.

Table 3.1 Net zero carbon initiatives

Item	Design initiatives included in the development's design
Resilience	A risk assessment will be undertaken to understand the potential future acute shocks and chronic stresses on the development and its operation. Areas that will be assessed are: - Climate Change adaptation capacity - Building operations, e.g., systems, design Based on the assessments above, a mitigation strategy will then be developed to address all high and extreme risks as a minimum.

3.2 Resilience

There have been a number of developments domestically and internationally that aim to inform and drive more resilient outcomes. Frameworks such as the United Nations Office for Disaster Risk Reduction, the Task Force on Climate-related Financial Disclosures (TCFD), 100 Resilient Cities program, the United Nation's Sustainable Development Goals (UNSDGs) and the Principles for Responsible Investment (UNPRI), have all suggested that assets must become more resilient to a range of impacts.

They have defined resilience in many ways, though there are several commonalities, such as focusing on climate change, anticipating the needs of affected communities, and considering resilience not just as a response to impacts, but as an opportunity to drive improvements.

The project team is committed to undertake an assessment to review potential risks to the building operations and its occupants in the building but also opportunities to address these risks early on.

[2] GBCA: Future in focus: Resilience in the built environment

4.0 Social sustainability

Sustainable design is not only about environmental aspects. Social and governance initiatives are equally important and must be considered for a good design outcome and the successful operation of a building.

4.1 Initiatives

The following table summarises the specific initiatives included in the design in relation to resilience.

Table 4.1 Social sustainability

Item	Design initiative included in the development's design
Indigenous and local heritage	Indigenous and local heritage will be acknowledged and celebrated through the potential inclusion of artworks, choice of materials or other design features.
Inclusion and accessibility	The building will be designed and constructed to be inclusive to a diverse range of people with different needs. The project investigates designing a number of apartments in line with the Livable Housing Gold Standard.
Inclusive construction and workforce	The head contractor will be required to provide gender inclusive facilities and protective equipment and will be required to have policies implemented on site that increase awareness and reduce instances of discrimination, racism and bullying.

4.2 Indigenous and local heritage

The Whadjuk people are the traditional owners of the Fremantle/Walyalup area, and the Town of East Fremantle recognises their cultural and heritage beliefs that are still important to the Noongar people to this day.

Aboriginal people have a long standing and deep connection with the East Fremantle area in general.

Investigation will be conducted to determine ways to incorporate indigenous inclusion, potentially through the development of artworks and choice of building materials.

The local heritage of the site will further be considered and celebrated in reusing materials from demolition works in the new development and the adjacent POS.

4.3 Inclusion and accessibility

Figure 4.1 Livable Housing (c) Architecture About People

A livable home is designed and built to meet the changing needs of occupants across their lifetime. Livable homes include key easy living features that make them easier and safer to use for all occupants including people with disability, ageing Australians, people with temporary injuries, and families with young children. All Australians benefit from homes designed with comfort, safety and ease of access as core design features. These features make the home easier for parents to manoeuvre prams, easier to carry the shopping into the house, easier for people with disability or temporary injury to get around and easier to move furniture. These same features enable key living spaces to be more easily, and cost effectively adapted to meet the changing needs and abilities of home occupants such as ageing baby boomers and people who have or acquire disability[3].

The project is investigating designing a number of apartments to the Gold Level Standard of Livable Housing Design which provides for more generous dimensions for most of the core livable housing design elements and introduces additional elements in areas such as the kitchen and bedroom.

[3] Livable Housing Design Guidelines, Fourth Edition, 2017

5.0 Resource consumption

The construction industry is responsible for around 20% of Australia's carbon footprint. These emissions include embodied energy and water consumption that goes into the building during construction as well as operational energy and water usage of the completed building, maintenance during the life span and the demolition at the end of the building's life.

The following sections set out design strategies being investigated for utilisation in this development to reduce the building's energy and water demand and waste.

5.1 Energy efficiency

The following table summarises the specific initiatives targeted for inclusion in the design in relation to energy efficiency:

Table 5.1 Energy efficiency initiatives

Item	Design initiative in the development design
Building fabric enhanced over NCC requirements	High-performance fabric and insulation. Minimum NatHERS of 6 stars and average NatHERS of 8 stars or above.
Lighting efficiency	All lighting will be LED, low energy lighting. Target lighting power density reduction by at least 10%.
Ventilation and air-conditioning	Ceiling fans will be considered Air conditioning equipment will be at least 3-star as per AS 3823.2-2011.
Appliances and equipment	All appliances installed will be energy and water efficient. Appliances to have a minimum Energy Star rating of 1-star below the maximum.

5.1.1 NatHERS

The Nationwide House Energy Rating Scheme (NatHERS) is a tool to assess the energy usage of residential dwellings. For a multi-residential development, every apartment is investigated as a separate unit with its own rating before an overall average rating is calculated. The NatHERS tool considers a wide range of parameters like orientation, glazing, insulation, size of rooms and door openings, shading and awnings and ceiling fans.

The NCC 2019 requires a minimum of a 5-tar NatHERS rating for the worst-performing apartment in the complex and an overall average of 6 Star. The proposed development is targeting to exceed these requirements by targeting a minimum of a 6 Star rating and an overall average of 8 Stars NatHERS or above.

5.1.2 Double glazing

The investigated double glazing to all facades provides good solar control to prevent summer heating while allowing useful passive solar heating in winter.

The low U-Value would minimize the conductive loss or gain. These result in an improved energy rating of apartments as well as a reduced overall carbon footprint of the development.

5.1.3 Natural and cross ventilation

All living rooms and bedrooms of the apartments and residential units are designed have operable glazing elements. These façade elements promote natural ventilation and allow for purging warm air at night. All apartments are also designed to have very good cross ventilation options.

When closed during the day, cool air can be stored within the apartment to reduce or eliminate the need for air conditioning. The generous openings to all living spaces also enable occupants to make use of the favourable outdoor conditions which prevail in the Perth region for 20% of the time, again reducing the need for mechanical heating or cooling during these times.

Figure 5.1 Exemplar cross ventilation on Levels 5-11

5.1.4 Ceiling fans

Ceiling fans can reduce cooling energy by up to 30% through the summer. Each residential apartment is proposed to be fitted with ceiling fans which will increase advantages of natural ventilation, will improve the indoor environment quality and improve the overall thermal comfort for occupants of the building. Ceiling fans are great way of cooling the space without the use of air-conditioning, which uses large amounts of energy in comparison.

5.1.5 Thermal bridging

Similar to airtightness, thermal bridging is the transference of heat through a wall at a point through which it can bypass the insulating layers of the structure. It is through these points in a building's envelope that they can experience unwanted heat gains and/or losses and as such will be considered when designing for sustainability and energy efficiency.

The architectural and structural detailing on the project will consider the issue of thermal bridging and will apply design principles to avoid unwanted heat losses or gains wherever possible through thermal breaks and other measures.

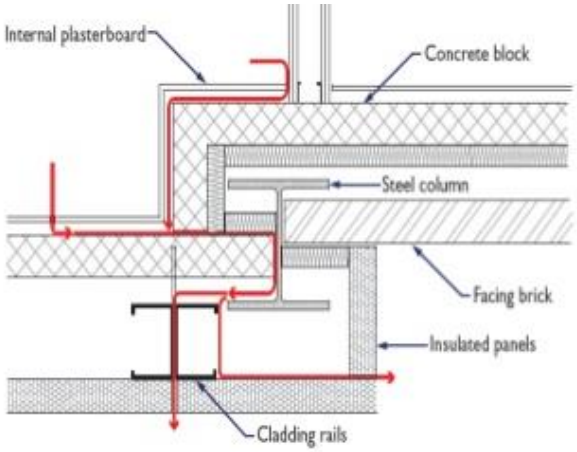

Figure 5.2 Exemplar continuous airtightness line of building details

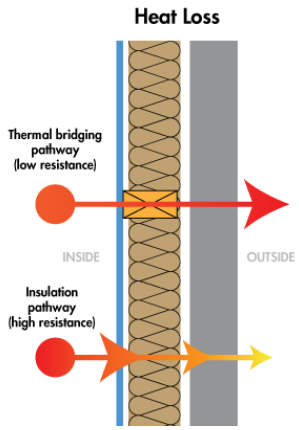

Figure 5.3 Thermal bridging principle

5.1.6 Light fittings

It will be considered to specify all light fittings as LED fittings including lighting in the 'communal' corridors, stairwells, garage and external lighting.

Additionally, downward facing fittings will be considered for the external landscaped areas to reduce the negative effects of light pollution. All common area lighting will incorporate light sensing such as occupancy sensing (PIRs) to reduce lighting consumption when lighting is not required.

5.2 Water Efficiency

The water consumption of Western Australia is the second highest in Australia with an average of 241,000 litres per household per annum, well above the Australian average of 190,000 litres (Australian Bureau of Statistics, 2017). A reduction of water usage does not only alleviate pressure from the local water supply but also means reduced costs of living in WA.

The following table summarises the specific initiatives to be investigated for inclusion in the design in relation to water efficiency:

Table 5.2 Water efficiency initiatives

Design Item	Design initiative
Potable water consumption	All water fittings and fixtures to be water efficient. All fixtures are to be at least within one star of the maximum WELS rating.
Landscape irrigation	All landscape irrigation will be drip irrigation with moisture sensing override where possible.
Recycled water	Options for water recycling and rainwater harvest are investigated.
Pool cover	A pool cover is considered to minimise evaporation and maximise heat retention

5.2.1 Water fixtures & fittings

Occupant consumption is a major contributor to potable water usage. The following water fixture WELS ratings will be considered to ensure the efficient use of potable water by building occupants (must be within 1-star).

Table 5.3 Proposed water fittings WELS rating

Fixture / Fitting Type	WELS Rating
Taps	6-star
Urinals	6-star
Toilets	5-star
Showers	3-star
Clothes Washing Machine	5-star
Dishwasher	6-star

5.2.2 Water-wise landscaping and drip irrigation

The user of water-wise landscaping will be considered for the project. This includes the use of hardy natives and other low-water vegetation. A major amount of potable water usage goes back to landscape irrigation. To reduce the amount of water used for the landscaped areas on the ground floor, a drip system with moisture sensor control may be installed for irrigation. For further information, refer to the Landscaping report.

Figure 5.4 Use of hardy natives and drip irrigation system for landscaping

5.2.3 Rainwater harvesting

Rainwater harvesting is the collection and storage of rain, rather than allowing it to run off. Rainwater is collected from a roof-like surface and redirected to a tank. The project is investigating rainwater harvesting options to reduce the need for potable water use for either the park area or inside the building for the common and/or commercial toilets.

5.2.4 Pool cover

The pool to is investigated to have an auto cover to minimise evaporation & maximise heat retention. The pool will further have no wet edge as this would promote evaporation & heat loss.

5.3 Waste

The main objectives for the waste management strategies for construction and operational waste are to ensure that waste is avoided and recycled during design, construction and operation.

Waste within a building construction context can be avoided by encouraging the selection of lower-impact and long-term materials. Operational waste to landfill can be reduced by providing relevant and easily accessible facilities for recyclable waste and other waste that can be diverted from landfill such as organic waste, batteries or e-waste.

The following table summarises the specific initiatives that will be investigated for inclusion in the design in relation to waste management:

Table 5.4 Waste initiatives

Item	Design initiative to be investigated for inclusion in the development's design
Construction waste	The amount of construction waste that is diverted from landfill will be maximised. Minimum 90% of waste from construction to be diverted from landfill.
Operational waste	Adequate facilities will be provided to store separate waste streams. A bin store is provided to cater for different waste streams. Good external and internal access to the storeroom to be provided.

5.3.1 Operational Waste

A dedicated waste storage area will be provided for the separation and storage of recyclable waste during operation, allowing for the different waste streams to be separated to match the local recycling scheme. At least three streams will be covered including landfill, recycling and a third stream which may be organic/food waste.

Throughout project design, operation and construction, principles of resource recovery will be applied, so that materials and products are recovered and reused where possible, reducing landfill and saving money. Some strategies that will be investigated include:

- Innovative waste separation and collection strategies to allow materials to be isolated for reuse;
- A purchasing policy which aims to minimise waste from products and packaging, encourage the use of products which have minimum environmental impact; and
- Manufacturers and suppliers will be encouraged to take full responsibility for the life cycle impact of products including ownership at end of life.

The project currently investigates separating a range of waste streams, including soft plastics, electronics and bulk verge collection (provision of storage space).

5.3.2 Organic waste strategy

The development should explore the possibility of recycling all forms of food and organic waste by identifying waste streams and incorporate a strategy that reduces food or organic waste going to landfills.

Space for FOGO bins will be provided in line with East Fremantle's waste management requirements. However, it will be explored whether there are opportunities to compost or dehydrate organic waste on site to use in the park or the vegetated areas around the building.

Figure 5.5 Sample composting scheme

6.0 Indoor environmental quality

The Indoor Environment Quality of a building aims to achieve sustainability performance improvements in a manner that also improves occupants' experience of the space. Sustainable buildings are designed for people and reductions in energy use should never be made at the expense of the occupants' health and wellbeing.

A holistic approach to sustainability will result in multiple benefits both in energy efficiency and encouraging occupant wellbeing. This can be achieved by improvements to air quality through appropriate ventilation, the provision of high levels of thermal, visual and acoustic comfort, reduction to occupant stress and the creation of a low-toxicity environment through the reduction of pollutants.

6.1 Design initiatives

The following table summarises the specific initiatives to be investigated for inclusion in the design in relation to Indoor Environment Quality:

Table 6.1 Indoor Environment Quality initiatives

Item	Design initiative targeted for inclusion in the development's design
Thermal comfort	High-performance double glazing. External shading through shading screens and soffits Average 8.0 Stars NatHERS or higher.
Fresh Air	All apartments are naturally ventilated All apartments are capable of cross-ventilation with high and low level openings. Individual dwellings maximised to optimise natural ventilation.
Daylight	Large windows with moderate Visual Light Transmittance (VLT) optimised for sufficient natural daylight. No apartments have a room depth greater than 3 x the ceiling height.
External Views	Good orientation with views to the on-site landscaped gardens/vegetation and neighbouring parks and swan river. Large windows with moderate Visual Light Transmittance (VLT).
Exposure to toxins	Specification of low VOCs in paints adhesives and sealants. 50% of paints will be ultra-low VOC. Low formaldehyde in engineered woods.
Internal lighting levels	All lighting will be LED or low energy, flicker-free and with no glare.
Acoustics	Acoustic separation between residential units. Compliance with acoustic requirements for external and internal noise levels. Acoustic separation and internal noise levels complying with Table 1 of AS/NZS2107:2016.

6.2 Amenity and comfort

The human body regulates its core temperature via the hypothalamus within a narrow range of 36 to 38 degrees. An indoor environment that is too hot or too cold can affect mood, performance and productivity. However, at which temperature a resident feels comfortable varies significantly from person to person. To control internal comfort and minimise excessive heat loss in winter and heat gains in summer, a number of strategies will be investigated for the proposed development:

- Façade design and glass selection are very important; heat gains and losses must be moderated, and thermal bridging should be avoided. Double glazing systems are considered for this development to improve the thermal performance of the building envelope.
- The high-performance glazing will additionally help to manage acoustic aspects of the building. Separated party walls between apartments will also reduce noise impacts from neighbouring flats.
- The façade will be well sealed to avoid draughts and air leakage.
- External shading and shading screens prevent excessive heat gains in summer.

6.3 Exposure to toxins

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors than outdoors. VOCs are emitted by a wide array of products numbering in the thousands (typically paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers).

The development will aim to specify materials with low emissions content including low-VOC and low formaldehyde content to avoid contaminating the indoor air. 50% of internal paints will be specified as ultra-low VOC.

Figure 6.1 VOCs that result in sick building syndrome

6.4 Natural lighting

Appropriate daylight is essential for users' wellbeing and connection to the outdoors, and for energy efficiency. However, excessive daylight can cause glare which is a major IEQ concern and must be avoided.

The development is designed such that every living space is designed to have large sliding doors to the balconies in addition to large full height windows to maximise daylight levels while shading devices are proposed to reduce glare.

The following design opportunities are considered throughout the detailed design process to maximise the daylighting potential:

- Large glazed and full height glazed areas to all living areas and bedrooms.
- glass with a moderate visual light transmittance (VLT) allows sufficient daylight to penetrate the space.
- Light internal colours improve indoor lighting levels.

Figure 6.2 Exemplar natural lighting intake Levels 5-11

7.0 Transport

Sustainable projects facilitate a reduction of the dependency of occupants on private car use as an important means of reducing overall greenhouse gas emissions. The use of motor vehicles directly contributes to climate change in two ways; through the high amounts of energy required to produce cars and build and maintain supporting road transport infrastructure and services; and the direct emissions that result from car operations.

If reliance on individual motor vehicle transportation is to be reduced, it is necessary to maximise alternative transportation options. This may include initiatives that encourage and make possible the use of mass transport options, cycling or walking, and the selection of sites that are close to a large number of amenities.

7.1 Design initiatives

The following table summarises the specific initiatives targeted for inclusion in the design in relation to transport:

Table 7.1 Transport initiatives

Item	Design initiative target for inclusion in the development's design
Providing bike storage	Bike storage will be provided for residents
Low emission vehicle infrastructure	Car parking bays and infrastructure for Electric Vehicles (EV) will be provided. All car bays will be equipped with the infrastructure for EV charging. Charging bays for electric bicycles and e-Scooters provided.
Improving pedestrian spaces	The building provides excellent access to amenities such as shops, cafes and bars. Many other amenities are less than 100m away from the site

7.2 Cyclist facilities

In the greater Perth area 48% of all car trips are less than 5 km distance. Cars produce an average of 0.3 kg of CO_2 per km travelled, whereas a cyclist emits negligible greenhouse or other pollution. For each kilometre a person cycles instead of driving, approximately 0.3 kg of CO_2 are saved from being emitted to the environment. Furthermore, cycling will encourage an active and healthy lifestyle for the residents.

The specific bicycle facilities required will be investigated, including determining inclusion of electric bicycle charging facilities and additional visitors bike racks as deemed necessary.

7.3 Access to public transport

With its location in East Fremantle along the Canning Highway, the proposed development is located in close proximity to several public bus routes. The closest bus stop is almost adjacent to the building on Canning Highway, therefore easily accessible by foot or bicycle and the bus.

7.4 Electric vehicles

The number of electric cars on the road grew to 3 million worldwide between 2016 and 2017. This is an expansion of 56%. With further expected exponential growth, the number of electric cars on the roads will reach between 125 and 220 million by 2030 according to the International Energy Agency (International Energy Agency, 2018).

The proposed development intents to support the uptake of low-emissions and electric vehicles. The target is for all car bays to have EV provisions. In addition, communal Electric Vehicles for car sharing.

All of the car parking spaces are planned to be dedicated to electric vehicles including the infrastructure required.

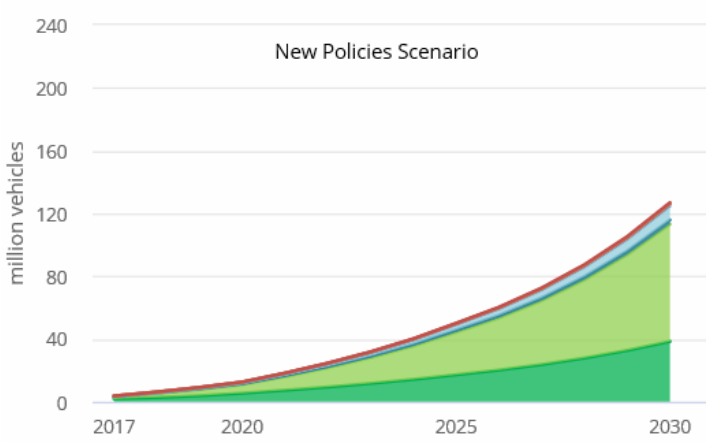

Figure 7.1 Global Electric Vehicle Deployment by 2030

8.0 Urban ecology

With continuously growing cities, urban ecology plays a large role in conserving biodiversity and improving life quality for urban residents. Well planned buildings and landscape architecture protects and enhances biodiversity, provides sustainable landscaping such as low water use, low fertiliser requirements and local native and indigenous plant species selection. If possible, remnant indigenous plant communities should be managed and protected.

8.1 Design initiatives

The following table summarises the specific initiatives included in the design in relation to urban ecology:

Table 8.1 Urban ecology initiatives

Item	Design initiative to be investigated for the development's design
Connection to nature	Extensive landscaping and park views will ensure a close connection to nature for all occupants
Mitigation of Light Pollution	95% of all external light fittings pointing downwards to mitigate the effect of urban light pollution.
Heat Island Effect Reduction	Use of vegetation, green spaces and SRI approved roofing will actively reduce the heat island effect. A minimum of 75% compliance is targeted

8.2 Connection to nature

Connection to nature is a key design element for the project and will ensure that occupants can interact with nature either inside the building or externally through landscaping across the outdoor areas or views across the river. Further initiatives such as a productive garden or partnerships with local community gardens are also investigated.

Figure 8.1 Visualisation of the adjacent Park and the southern facade

8.3 Light Pollution

Light pollution is an environmental issue that is becoming more of a problem every year as cities continue to grow in size and density. Excessive amounts of light being projected upwards is not only a waste of energy and resources but has also been proven to make a negative impact on the local wildlife by affecting various species' vision, mating, nesting and built-in migration instincts.

Similar effects have been found in humans, with some people struggling to sleep and relax with prolonged exposure to artificial daylight and glare from poorly fitted external lights. The idea of reducing light pollution through sensible light fittings can save the site owners financially by reducing wasted energy and increasing lighting efficiency whilst simultaneously contributing positively to the health and wellbeing of the surrounding natural environment.

The project will investigate the use of all external light fittings pointing downwards, mitigating the effects of light pollution.

Figure 8.2 Light and energy usage of external lighting

8.4 Minimising heat island effect

The heat island effect describes the condition where urban areas have a higher average temperature than its rural surroundings owing to the make-up of the built environment. The use of light roof materials combined with shaded and landscaped areas can reduce the heat island effect significantly and contributes to further energy savings.

The development includes extensive landscaped areas across the podium levels minimising the effects of the heat island effect. The use of light-coloured materials with a Solar Reflectance Index (SRI) value of minimum 64 will be investigated.

9.0 Codes and Ratings

The building will be subject to voluntary and mandatory building codes and metrics to measure the performance of the rating. This section of the report outlines the main codes and ratings and identifies the project's response.

9.1 NatHERS

Residential building compliance is achieved through a thermal modelling process defined as the Nationwide House Energy Rating Scheme (NatHERS). This process requires a minimum star rating to be achieved for the building's thermal comfort, which informs the energy efficiency of the building. The Nationwide House Energy Rating Scheme (NatHERS) is a tool to assess residential dwellings' energy usage. For a multi-residential project such as Common Ground, every apartment is investigated as a separate unit with its own rating before an overall average rating is calculated. The NatHERS tool considers a wide range of parameters like orientation, glazing, insulation, size of rooms and door openings, shading and awnings and ceiling fans.

The National Construction Code (NCC) requires a minimum of a 5 Star NatHERS rating for the worst-performing apartment in the complex and an overall average NatHERS rating of 8 Stars. The proposed development is aiming to exceed these requirements, reducing the building's average energy consumption by approximately 44%.

Table 9.1 NatHERS target

	Minimum NCC Requirement	Target for the proposed development
Worst case NatHERS rating	5 Stars	6 Stars
Overall average NatHERS rating	6 Stars	8 Stars
Estimated Average Energy Usage	39 MJ/m^2	17.2 MJ/m^2 (44% reduction)

9.2 NABERS

NABERS (National Australian Built Environment Rating System) provides simple, reliable, and comparable sustainability measurement for non-residential spaces within a building. The NABERS rating helps to accurately measure, understand, and communicate the environmental performance of the building while identifying areas for cost savings and future improvements. NABERS Energy Ratings are awarded on a scale of 1 to 6 Stars where 3 Stars represent the average performance across all NABERS rating buildings in Australia

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The 91-93 Canning Highway development targets a 5-star NABERS Rating for the commercial spaces reducing the energy consumption of these spaces by 46%.

Table 9.2 NABERS target

	Average NABERS Rating	Target for the proposed development
Star Rating	3 Stars	5 Stars
Estimated annual energy usage	620,000 kWh	333,000 kWh (46% reduction)

9.3 Green Star

The development is being designed to fulfil all requirements in terms of Ecologically Sustainable Design (ESD) and is aiming to achieve a 5-star Green Star Buildings rating.

Following extensive consultation, the GBCA's Future Focus program resulted in significant changes to the Green Star rating system, including a revised and expanded framework that includes a greater social focus, increased stringency for the highest rating, and an increased focus on reducing carbon emissions. Green Star Buildings reflects three years of engagement with industry. This extensive engagement process lends confidence that the rating tool reflects the issue and opportunities facing the built environment over the coming decade.

Green Star Buildings is a rating tool developed to rate the design and construction of any building. Green Star Buildings aims to assist clients and project teams to achieve and rate their sustainability goals for their project, encourage a new approach by rewarding healthy, resilient, and positive best practice outcomes and excellence and provide consistent and clear advice in an easy-to-use manner.

Green Star Buildings features eight categories representing the issues that will define the next decade of the built environment. Ratings are available as a 4-, 5- and 6-star Rating. Buildings targeting a 6-star rating must be net zero energy for their operations. For a 4- and 5-star rating, a pathway to future proof the building towards being net zero in energy must be show. This ultimately means that no gas should be used in a Green Star Buildings rated development.

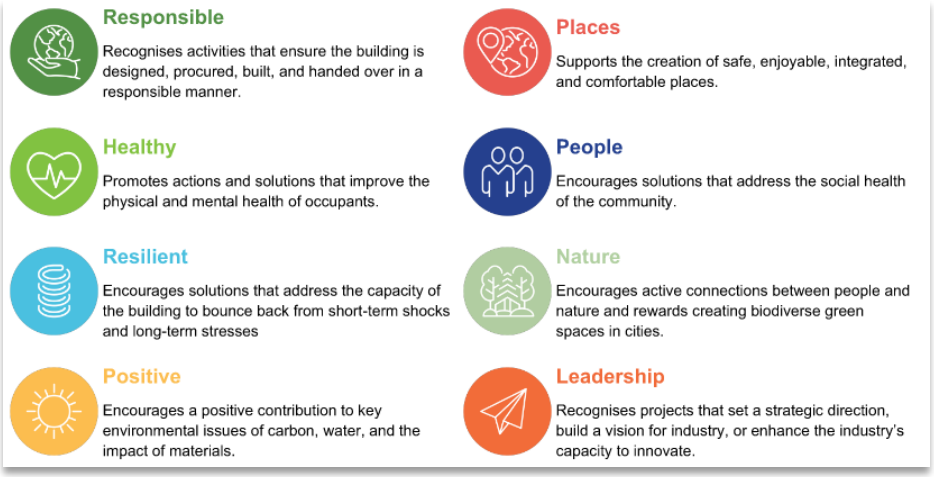

Figure 9.1 Green Star Buildings categories

A 5-star Green Star Buildings v1 rating requires a total of 35 points to be achieved across eight categories.

Sufficient weighted credits have been selected to achieve this requirement rating, and further opportunities will be pursued during the design stages of the project.

Based on the proposed design response, the predicted performance in each respective environmental category is tabulated in the Scorecard in ***Appendix A***. The sustainability strategy of this development demonstrates how the development is proposing to achieve the 6-star Green Star benchmark.

Table 9.3 Green Star target

Total available points	Minimum points required for 5-star Green Star	Points target for the proposed development
100 Points	35 Points	**36 Points**

10.0 References

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Appendix A Green Star strategy

Submission planner

Summary

Registering from	2020 onwards		
Net zero carbon in operations targeted	No	**Targeted Green Star rating**	5 Star
Minimum expectations met	Yes	**Core points targeted**	35
Credit Achievement points targeted	31	**Leadership points targeted**	1
Exceptional Performance points targeted	4	**Total points targeted**	36

	Credit	Minimum Expectation	Credit Achievement	Exceptional Performance	Total points available	Targeted performance level	Total points targeted	Comments
Responsible					**17**			
1	Industry Development	-	1	-	**1**	Credit Achievement	**1**	**Credit:** The building owner or developer appoints a Green Star Accredited Professional, discloses the cost of sustainable building practices to the GBCA, and markets the building's sustainability achievements.
2	Responsible Construction	•	1	-	**1**	Credit Achievement	**1**	**Min:** The Contractor has an EMS & EMP in place to manage impacts on site. Divert at least 80% of construction & demolition waste from landfill. The Contractor provides training on the sustainability targets of the building. **Credit:** 90% of construction and demolition waste is diverted from landfill, and waste contractors and facilities comply with the Green Star Construction and Demolition Waste Reporting Criteria.
3	Verification and Handover	•	1	-	**1**	Credit Achievement	**1**	**Min:** The building has been commissioned and will be tuned, set up for optimum ongoing management (metering and monitoring). The project team create and deliver O&M information to the FM team at the time of handover. Information is available to building users on how to best use the building. **Credit:** Independent verification for commissioning and tuning through ICA or soft landings approach that involves the future FM team. For large projects both must occur.
4	Operational Waste	•	-	-	**0**	Minimum Expectation	•	**Min:** Demonstrate the building is designed to allow effective management of operational waste by: separating waste streams; dedicated and adequately sized waste storage area; and ensuring easy and safe access to waste storage areas for both occupants and waste collection contractors.
5	Responsible Procurement	-	1	-	**1**			**Credit:** The building's design and construction procurement process follows ISO 20400 Sustainable Procurement - Guidance and at least one identified supply chain risk and opportunity is addressed.
6	Responsible Structure	-	3	2	**5**			**Credit:** 80% of all structural components (by cost) meet a Responsible Products Value (RPV) score of at least 10. **Exceptional:** Credit plus either: 10% of all products in the structure (by cost) meet a RPV score of at least 15, OR 30% of all products in the structure (by cost) have an average RPV score of at least 12.
7	Responsible Envelope	-	2	2	**4**			**Credit:** 60% of all building envelope components (by cost) meet a Responsible Products Value (RPV) score of at least 10. **Exceptional:** Credit plus either: 10% of all products in building envelope (by cost) meet a RPV score of at least 15, OR 25% of all products in the building envelope (by cost) have an average RPV score of at least 12.
8	Responsible Systems	-	1	1	**2**			**Credit:** 20% of all active building systems (by cost) meet a Responsible Products Value (RPV) score of at least 6. **Exceptional:** Credit plus either: 5% of all active building systems (by cost) meet a RPV score of at least 11, OR 15% of all active building systems (by cost) have an average RPV score of at least 8.
9	Responsible Finishes	-	1	1	**2**			**Credit:** 60% of all internal building finishes (by area) meet a Responsible Products Value (RPV) score of at least 7. **Exceptional:** Credit plus either: 10% of all internal building finishes (by area) meet a RPV score of at least 12, OR 20% of all internal building finishes (by area) have an average RPV score of at least 9.
						Total	**3**	
Healthy					**14**			
10	Clean Air	•	2	-	**2**	Credit Achievement	**2**	**Min:** Levels of indoor pollutants are maintained at acceptable levels, a high level of fresh air is provided and Pollutants entering the building are minimised. **Credit:** The building's ventilation systems allow for easy maintenance and high levels of outdoor air are provided.
11	Light Quality	•	2	2	**4**	Credit Achievement	**2**	**Min:** Lighting within the building meets minimum comfort requirements, good lighting levels suitable for the typical tasks in each space are available, and the building provides adequate levels of daylight. **Credit:** The building provides either best practice Artificial Lighting or best practice access to daylight. **Exceptional:** The building provides both best practice Artificial Lighting and best practice access to daylight.
12	Acoustic Comfort	•	2	-	**2**	Credit Achievement	**2**	**Min:** An Acoustic Comfort Strategy is prepared to describe how the building and acoustic design aims to deliver acoustic comfort to the building occupants. **Credit:** Depending on the building typology achieve 2 to 4 of the acoustic critera: maximum internal noise levels; minimum internal noise levels; provides acoustic separation; minimises impact noise transfer; and/or is designed with reverberation control.
13	Exposure to Toxins	•	2	-	**2**	Minimum Expectation	•	**Min:** The building's paints adhesives, sealants, carpets, and engineered wood products are low in TVOC and formaldehyde or non-toxic. Occupants are not exposed to banned or highly toxic materials in the building. **Credit:** On-site tests verify the building has low Volatile Organic Compounds (VOC) and formaldehyde levels.
14	Amenity and Comfort	-	2	-	**2**	Credit Achievement	**2**	**Credit:** The building has dedicated amenity rooms to act as parent room, a relaxation room, or an exercise room.
15	Connection to Nature	-	1	1	**2**			**Credit:** The building provides views, 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. **Exceptional:** The building provides both credits options.
						Total	**8**	
Resilient					**8**			
16	Climate Change Resilience	•	1	-	**1**	Minimum Expectation	•	**Min:** The project team completes the climate change pre-screening checklist and communicates the building's exposure to climate change risks to the applicant. **Credit:** The project team develops a project-specific climate change risk and adaptation assessment for the building. Extreme and high risks are addressed.
17	Operations Resilience	-	2	-	**2**	Credit Achievement	**2**	**Credit:** A comprehensive review of future building operational shocks and stresses are undertaken. Building design and future operational plan addresses high or extreme system-level interdependency risks and level of survivability in a blackout.
18	Community Resilience	-	1	-	**1**			**Credit:** The project team undertakes a needs analysis of the community, identifies shocks and stresses that impact the building's ability to service the community, and develops responses to manage these.
19	Heat Resilience	-	1	-	**1**	Credit Achievement	**1**	**Credit:** At least 75% of the whole site area comprises of one or a combination of strategies that reduce the heat island effect.
20	Grid Resilience	-	3	-	**3**			**Credit:** The project meets one or several of: (1) active generation and storage systems, (2) demand response strategy, or (3) reduced electricity consumption through passive design.
						Total	**3**	
Positive					**30**			
21	Upfront Carbon Emissions	•	3	3	**6**	Minimum Expectation	•	**Min:** The building's upfront carbon emissions are at least 10% less than those of a reference building. **Credit:** The building's upfront carbon emissions are at least 20% less than those of a reference building. [Climate Positive Pathway]. Demoltion works must be offset. **Exceptional:** The building's upfront carbon emissions are at least 40% less than those of a reference building.
22	Energy Use	•	3	3	**6**	Exceptional Performance	**6**	**Residential Pathway:** **Min:** Average NatHERS rating of 6.5 Star, minimum 5 Stars **Credit:** Average NatHERS of 7 Stars, minimum 5.5 Stars [Climate Positive Pathway] **Exceptional:** Average NatHERS rating of 8 Stars, minimum 6 Stars
23	Energy Source	•	3	3	**6**	Credit Achievement	**3**	**Min:** The building provides a Zero Carbon Action Plan. **Credit:** 100% of the building's electricity comes from renewable electricity. **Exceptional:** 100% of the building's energy comes from renewables. No gas is used for space heating, domestic hot water or cooking. [Climate Positive Pathway]
24	Other Carbon Emissions	-	2	2	**4**			**Credit:** The building owner eliminates or offsets emissions from refrigerants. [Climate Positive Pathway] **Exceptional:** All other emissions not captured in the Positive category are eliminated or offset including all Upfront Carbon Emssions (embodied carbon).
25	Water Use	•	3	3	**6**	Minimum Expectation	•	**Min:** The building installs efficient water fixtures or uses 15% less potable water compared to a reference building. Multi-unit residential buildings use 10% less potable water compared to a reference building. **Credit:** The building uses 45% less potable water compared to a reference building (40% for reseidential). The building has infrastructure for recycled water connection. **Exceptional:** The building uses 75% less potable water compared to a reference building (60% for residential).
26	Life Cycle Impacts	-	2	-	**2**			**Credit:** The project demonstrates a 30% reduction in life cycle impacts when compared to standard practice.
						Total	**9**	
Places					**8**			
27	Movement and Place	•	3	-	**3**	Credit Achievement	**3**	**Min:** The building includes showers and changing facilities for building occupants that are accessible, inclusive and located in a safe and protected space. **Credit:** The building's access prioritises cycling and includes bicycle parking facilities, a Sustainable Transport Plan has been prepared and implemented, the building has EV charging capabilities, transport options that reduce the need for private fossil fuel vehicles are prioritised, and the building's design and location encourage walking.
28	Enjoyable Places	-	2	-	**2**			**Credit:** The building delivers memorable, beautiful, vibrant communal or public places where people want to gather and participate in the community. The spaces are inclusive, safe, flexible and enjoyable.
29	Contribution to Place	-	2	-	**2**	Credit Achievement	**2**	**Credit:** The building's design contributes to the liveability of the wider urban context and enhances the public realm.
30	Culture, Heritage and Identity	-	1	-	**1**	Credit Achievement	**1**	**Credit:** The building's design reflects and celebrates local demographics and identities, the history of the place, and any hidden or minority entities. This celebration was arrived through meaningful engagement with community groups early in the design process.
						Total	**6**	
People					**9**			
31	Inclusive Construction Practices	•	1	-	**1**	Credit Achievement	**1**	**Min:** During construction, the head contractor provides gender inclusive facilities and protective equipment. Policies are implemented on-site to increase awareness and reduces instances of discrimination, racism and bullying. **Credit:** The head contractor provides and monitors high quality staff support on-site to reduce at least five key physical and mental health impacts relevant to construction workers. They must also evaluate the effectivenss of their interventions.
32	Indigenous Inclusion	-	2	-	**2**			**Credit:** The building's design and construction celebrates Aboriginal and Torres Strait Islander people, culture and heritage through playing an active role in the organisational RAP and/or incorporating Indigenous Design and Planning principles.
33	Procurement and Workforce Inclusion	-	2	1	**3**			**Credit:** At least 2% of the building's total contract value has been directed to generate employment opportunities for disadvantaged and under-represented groups through a social procurement strategy **Exceptional:** At least 4% of the building's total contract value has been directed to generate employment opportunities for disadvantaged and under-represented groups thorugh a social procurement strategy.
34	Design for Inclusion	-	2	1	**3**	Exceptional Performance	**3**	**Credit:** The building is designed and constructed to be inclusive to a diverse range of people with different needs. **Exceptional:** Engagement with target groups has informed the inclusive design.
						Total	**4**	
Nature					**14**			
35	Impacts to Nature	•	2	-	**2**	Minimum Expectation	•	**Min:** The building was not built on, or significantly impacted, a site with a high ecological value. **Credit:** The building's design and construction conserves existing natural elements, and (if deemed necessary by an Ecologist) at least 50% of existing site with high biodiversity value is retained
36	Biodiversity Enhancement	-	2	2	**4**	Credit Achievement	**2**	**Credit:** The site includes an appropriate landscape area with a diversity of species and prioritises the use of climate-resilient and indigenous plants, AND a site-specific Biodiversity Management Plan is provided to the building owner or building owner representative. **Exceptional:** A greater area of landscaping is provided and the landscaping includes critically endangered and/or endangered plant species native to the bioregion.
37	Nature Connectivity	-	2	-	**2**			**Credit:** The site must be built to encourage species connectivity through the site, and to adjacent sites. If the project sits within a blue or green grid strategy it must contribute to the goals of the strategy.
38	Nature Stewardship	-	2	-	**2**			**Credit:** The building owner, as part of the project's development, undertakes activities that protects or restores biodiversity at scale beyond the development's boundary.
39	Waterway Protection	-	2	2	**4**			**Credit:** The building demonstrates an annual average flow reduction (ML/yr) of 40% and meets specified pollutants targets. **Exceptional:** The building demonstrates an annual average flow reduction (ML/yr) of 80% and meets specified pollutants targets.
						Total	**2**	
Leadership					**0**			
40	Market Transformation	-		-	**0**			
41	Leadership Challenges	-		-	**0**		**1**	**Credit:** The project team identifies and implements circular economy principles and initiatives. The project team demonstrates an increased circularity of 10% (weighted by cost) **Exceptional:** The project team demonstrates an increased circularity of 20% (weighted by cost)
						Total	**1**	

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